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MEDICO-CHIRURGICAL TRANSACTIONS.

PUBLISHED BY

THE ROYAL

MEDICAL AND CHIRURGICAL SOCIETY

OF

LONDON.

VOLUME THE FIFTY-THIRD.

LONDON:
LONGMANS, GREEN, READER, AND DYER,
PATERNOSTER ROW.

1870.

PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

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OF LONDON.

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1808. MATTHEW BAILLIE, M.D.
1810. SIR HENRY HALFORD, Bart., M.D., G.C.H.
1813. SIR GILBERT BLANE, Bart., M.D.
1815. HENRY CLINE.
1817. WILLIAM BABINGTON, M.D.
1819. SIR ASTLEY PASTON COOPER, Bart., K.C.H., D.C.L.
1821. JOHN COOKE, M.D.
1823. JOHN ABERNETHY.
1825. GEORGE BIRKBECK, M.D.
1827. BENJAMIN TRAVERS.
1829. PETER MARK ROGET, M.D.
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1839. SIR BENJAMIN COLLINS BRODIE, Bart., D.C.L.
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1847. JAMES MONCRIEFF ARNOTT.
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1857. SIR CHARLES LOCOCK, Bart., M.D.
1859. FREDERIC CARPENTER SKEY.
1861. BENJAMIN GUY BABINGTON, M.D.
1863. RICHARD PARTRIDGE.
1865. SIR JAMES ALDERSON, M.D.
1867. SAMUEL SOLLY.
1869. GEORGE BURROWS, M.D.

FELLOWS

OF THE

ROYAL MEDICAL AND CHIRURGICAL SOCIETY

OF LONDON.

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P.—President.	V.P.—Vice-President.
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L.—Librarian.	C.—Member of Council.

The figures succeeding the words *Trans.* and *Pro.* show the number of Papers which have been contributed to the Transactions or Proceedings by the Fellow to whose name they are annexed. *Sci. Com.* is attached to the names of those who have served on the Scientific Committees of the Society.

OCTOBER, 1870.

Those marked thus (†) have paid the Composition Fee in lieu of further annual subscriptions.

Amongst the non-residents, those marked thus (*) are entitled by composition to receive the Transactions.

Elected

1841 *Abercrombie, James, M.D., Cape of Good Hope.

1869 Abercrombie, James, jun., M.D., Cape Town, Cape of Good Hope.

1846 *Abercrombie, John, M.D., Physician to the Cheltenham General Hospital, 13, Suffolk-square, Cheltenham.

1851 *Acland, Henry Wentworth, M.D., F.R.S., Honorary Physician to H.R.H. the Prince of Wales; Physician to the Radcliffe Infirmary; Regius Professor of Medicine, and Clinical Professor in the University of Oxford.

1847 Acosta, Elisha, M.D., 24, Rue de Luxembourg, St. Honoré, Paris.

Elected

1842 Acton, William, 17, Queen Anne street, Cavendish square. *Trans.* 1.

1852 Adams, William, Surgeon to the Royal Orthopædic Hospital; 5, Henrietta street, Cavendish square, *Trans.* 2.

1867 Aikin, Charles Arthur, 7, Clifton place, Hyde park.

1837 *Ainsworth, Ralph Fawsett, M.D., Consulting Physician to the Manchester Royal Infirmary; Cliff Point, Lower Broughton, Manchester.

1839 Alcock, Sir Rutherford, K.C.B., K.C.T., K.T.S., D.C.L., H.M.'s Envoy Extraordinary at the Court of Pekin. *Trans.* 1.

1826 Alderson, Sir James, M.D., D.C.L., F.R.S., President of the Royal College of Physicians; 17, Berkeley square. S. 1829. C. 1848. T. 1849. V.P. 1852-3. P. 1865-6. *Trans.* 3.

1843 Aldis, Charles James Berridge, M.D., Medical Officer of Health for St. George's, Hanover square; Senior Physician to the Surrey Dispensary; and Physician to the St. Paul and St. Barnabas Dispensary; 45B, Chester Square. *Trans.* 2.

1850 Alexander, Charles Revans, Surgeon to the Royal Infirmary for Diseases of the Eye; 6, Cork street, Bond street.

1866 Allbutt, Thomas Clifford, M.A. and M.D., F.L.S., Lecturer on the Practice of Physic at the Leeds School of Medicine, and Physician to the Leeds General Infirmary; 38, Park square, Leeds. *Trans.* 3.

1869 Allen, Peter, M.D., Aural Surgeon to St. Mary's Hospital; 15, Savile row.

1863 Althaus, Julius, M.D., 18, Bryanston street, Portman square, *Trans.* 1.

1862 Andrew, Edwin, M.D., Windsor House, Castle street, Shrewsbury.

1862 Andrew, James, M.D., Physician to, and Lecturer on Medicine at, St. Bartholomew's Hospital; 59, Russell square.

1820 Andrews, Thomas, M.D., Norfolk, Virginia.

Elected

1867 Anstie, Francis Edmund, M.D., Senior Assistant-Physician and Lecturer on Medicine at the Westminster Hospital; 16, Wimpole street, Cavendish square.

1870 Arnott, Henry, Assistant-Surgeon to, and Lecturer on Pathology at, the Middlesex Hospital; 6, Nottingham place, Marylebone road.

1819 †Arnott, James Moncrieff, F.R.S., Chapel House, Lady Bank, Fifeshire. L. 1826-8. V.P. 1832-3. T. 1835-40. C. 1846, 1855-6. P. 1847-8. *Trans.* 8.

1817 †Ashburner, John, M.D., F.L.S., 1, Hyde park place, Cumberland gate. C. 1821, 1830-31.

1851 Ashton, Thomas John, Consulting Surgeon to the St. Marylebone Infirmary; 31, Cavendish square.

1836 Baird, Andrew Wood, M.D., Physician to the Dover Hospital; 7, Camden crescent, Dover, Kent.

1851 *Baker, Alfred, Surgeon to the Birmingham General Hospital; 20a, Temple row, Birmingham.

1865 Baker, William Morrant, Lecturer on Anatomy and Physiology, and Warden of the College, St. Bartholomew's Hospital. *Trans.* 2.

1869 Bakewell, Robert Hall, M.D., Medical Officer of Health; Trinidad, West Indies.

1839 †Balfour, Thomas Graham, M.D., F.R.S., Deputy Inspector-General of Hospitals; 6, Whitehall yard. C. 1852-3. V.P. 1860-1. *Trans.* 2.

1848 Ballard, Edward, M.D., Medical Officer of Health for Islington; 7, Compton terrace, Islington. *Trans.* 5.

1849 Ballard, Thomas, M.D., 10, Southwick place, Hyde park square.

1866 *Banks, John Thomas, M.D., Physician to Richmond, Whitworth, and Hardwicke Hospitals; Consulting Physician to the Coombe Hospital; 10, Merrion square east, Dublin.

1847 Barclay, Andrew Whyte, M.D., Physician to, and Lecturer on Medicine at, St. George's Hospital; Medical Officer of Health for Chelsea; 23a, Bruton street, Berkeley square. S. 1857-60. L. 1861-2. C. 1865-6. *Trans.* 2.

Elected

1862 Barker, Edgar, jun., 6, Upper Hyde park street.

1833 †Barker, Thomas Alfred, M.D., Consulting Physician to, and Lecturer on Medicine at, St. Thomas's Hospital; 27, Wimpole street. C. 1844-5. V.P. 1853-4. T. 1860-2. *Trans.* 6.

1861 Barnes, Robert, M.D., Obstetric Physician to, and Lecturer on Midwifery at, St. Thomas's Hospital; Examiner in Midwifery at the University of London; 31, Grosvenor street. *Trans.* 4.

1864 Barratt, Joseph Gillman, M.D, 8, Cleveland gardens, Bayswater.

1840 Barrow, Benjamin, Surgeon to the Royal Isle of Wight Infirmary; Southlands, Ryde, Isle of Wight.

1859 Barwell, Richard, Surgeon to, and Lecturer on Anatomy at, the Charing Cross Hospital; 32, George street, Hanover square. *Trans.* 1.

1844 Basham, William Richard, M.D., Senior Physician to, and Lecturer on Medicine at, the Westminster Hospital; 17, Chester street, Belgrave square. S. 1852-4. C. 1860-1. V.P. 1864-5. *Trans.* 2.

1868 Bastian, Henry Charlton, M.A., M.D., F.R.S., Professor of Pathological Anatomy in University College, London, and Assistant-Physician to University College Hospital; 20, Queen Anne street, Cavendish square. *Trans.* 1.

1862 Beale, Lionel Smith, M.B., F.R.S., Professor of Pathological Anatomy in King's College, London, and Physician to King's College Hospital; 61, Grosvenor street. *Trans.* 1.

1860 Bealey, Adam, M.D., M.A., Camb., Birch Lea, Harrogate.

1841 Beaman, George, M.D., 3, Henrietta street, Covent garden.

1856 Beardsley, Amos, F.L.S., Bay villa, Grange-over-Sands, Lancashire.

1865 Beattie, Henry, M.D., 5, Albert square, Commercial road east.

Elected

1836 Beaumont, William Rawlings, Consulting Surgeon to the Toronto General Hospital; Toronto, Canada West. *Trans.* 3.

1840 Beevor, Charles, 129, Harley street, Cavendish square.

1858 Begley, William Chapman, M.D., Middlesex County Lunatic Asylum, Hanwell.

1819 †Bell, Thomas, F.R.S., F.L.S., The Wakes, Selborne, Hants. C. 1832-3. V.P. 1854. *Trans.* 1.

1847 Bennet, James Henry, M.D., The Ferns, Weybridge, and Mentone.

1845 Berry, Edward Unwin, 76, Gower street, Bedford square.

1820 Bertin, Stephen, Paris.

1865 *Bickersteth, Edward Robert, Surgeon to the Liverpool Royal Infirmary, and Lecturer on Clinical Surgery in the Liverpool Royal Infirmary School of Medicine; 2, Rodney street, Liverpool.

1815 †Billing, Archibald, M.D., F.R.S., Member of the Senate of the University of London; 6, Grosvenor gate. C. 1825. V.P. 1828-9.

1854 Bird, Peter Hinckes, F.L.S., 1, Norfolk square, Hyde park.

1856 Bird, William, Surgeon to the West London Hospital; Bute House, Hammersmith.

1849 Birkett, Edmund Lloyd, M.D., Physician to the City of London Hospital for Diseases of the Chest; 48, Russell square. C. 1865-6.

1851 Birkett, John, F.L.S., *Treasurer*, Surgeon to, and Lecturer on Surgery at, Guy's Hospital; Professor of Pathology and Surgery to the Royal College of Surgeons; Examiner in Surgery at the University of London; 59, Green street, Grosvenor square. L. 1856-7. S. 1863-5. C. 1867-8. T. 1870. *Trans* 8. *Sci. Com.*

1866 Bishop, Edward, M.D., Cintra park, Upper Norwood.

1843 Black, Patrick, M.D., *Treasurer*, Physician to, and Lecturer on Medicine at, St. Bartholomew's Hospital; 11, Queen Anne street, Cavendish square. C. 1856. V.P. 1866. T. 1869-70.

Elected

1847 Blackman, George C., M.D., Professor of Surgery in the Medical College of Ohio ; New York, U.S.

1840 Blakiston, Peyton, M.D., F.R.S., St. Leonard's-on-Sea.

1865 Blanchet, Hilarion, Examiner to the College of Physicians and Surgeons, Lower Canada; 6, Palace street, Quebec, Canada east.

1865 Blandford, George Fielding, M.D., Lecturer on Psychological Medicine at St. George's Hospital; 71, Grosvenor street.

1867 Bloxam, John Astley, Surgical Registrar to St. Bartholomew's Hospital; The College, St. Bartholomew's.

1823 Bojanus, Louis Henry, M.D., Wilna.

1846 Bostock, John Ashton, *Vice-President*, Hon. Surgeon to H.M. the Queen ; Surgeon-Major Scots Fusilier Guards; 54, Chester square, Belgravia. C. 1861-2. V.P. 1870. *Sci. Com.*

1869 Bourne, Walter, M.D.

1870 *Bowles, Robert Leamon, M.D., 8, West terrace, Folkestone.

1841 Bowman, William, F.R.S., F.L.S., Surgeon to the Royal London Ophthalmic Hospital, Moorfields; 5, Clifford street, Bond street. C. 1852-3. V.P. 1862. *Trans.* 3.

1862 Brace, William Henry, M.D., 12, Eccleston square, Pimlico.

1867 *Brett, Alfred T., M.D., Watford, Herts.

1867 Bridgewater, Thomas, M.B., Lond., Harrow-on-the-Hill, Middlesex.

1868 Broadbent, William Henry, M.D., Assistant-Physician to, and Lecturer on Physiology at, St. Mary's Hospital; Physician to the London Fever Hospital; 44, Seymour street, Portman square.

1851 Brodhurst, Bernard Edward, F.L.S., Surgeon to the Orthopædic Department of, and Lecturer on Orthopædic Surgery at, St. George's Hospital, and Assistant-Surgeon to the Royal Orthopædic Hospital; 20, Grosvenor street. C. 1868-9. *Trans.* 2. *Pro.* 1.

Elected

1844 †Brooke, Charles, M.A., F.R.S., *Librarian*, Consulting Surgeon to the Westminster Hospital; 16, Fitzroy square. C. 1855. L. 1866-70.

1857 *Brown, Robert, Surgeon to the Cumberland Infirmary, 5, Devonshire street, Carlisle.

1860 Brown-Sequard, Charles Edouard, M.D., F.R.S., late Professor of Physiology and Pathology, Massachusetts Medical College, Harvard University, Boston, U.S.; Professor of Comparative Pathology to the Faculty of Medicine, Paris; Rue Gay-Lussac, 28, Paris. *Sci. Com.*

1851 Browne, Alexander, M.D., Twynholm, Kirkcudbright.

1867 Brunjes, Martin, 42, Brook street, Grosvenor square.

1860 Bryant, Thomas, Assistant-Surgeon to, and Demonstrator of Operative Surgery at, Guy's Hospital; 2, Finsbury square. *Trans.* 7; *Pro.* 1. *Sci. Com.*

1855 Bryant, Walter John, L.R.C.P. Edinb.; 23a, Sussex square, Hyde park gardens.

1823 Buchanan, B. Bartlet, M.D.

1864 Buchanan, George, M.D., Medical Inspector for the Privy Council; 24, Nottingham place.

1864 Buckle, Fleetwood, M.D.

1839 Budd, George, M.D., F.R.S., Consulting Physician to the 'Dreadnought' Seamen's Hospital; Ashleigh, Barnstaple. C. 1846-7. V.P. 1857. *Trans.* 5.

1833 †Burrows, George, M.D., F.R.S., *President*, Physician Extraordinary to H.M. the Queen; Consulting Physician to St. Bartholomew's Hospital; Physician to Christ's Hospital; Member of the Senate of the University of London; 18, Cavendish square. C. 1839-40, 1858-9. T. 1845-7. V.P. 1849-50. P. 1869-70. *Trans.* 2.

1837 †Busk, George, F.R.S., F.L.S., Consulting Surgeon to the 'Dreadnought' Seamen's Hospital; 32, Harley street, Cavendish square. C. 1847-8. V.P. 1855. T. 1866. *Trans.* 4.

1870 Butt, William F., 12, South street, Park lane.

Elected

1818 Butter, John, M.D., F.R.S., F.L.S., Physician Extraordinary to the Plymouth Royal Eye Infirmary; Windsor villa, Plymouth.

1868 Buzzard, Thomas, M.D., Physician to the National Hospital for the Epileptic and Paralysed; 56, Grosvenor street, Grosvenor square.

1851 *Cadge, William, Surgeon to the Norfolk and Norwich Hospital; 24, St. Giles's street, Norwich. *Trans.* 1.

1861 Callender, George William, Assistant-Surgeon to, and Lecturer on Anatomy at, St. Bartholomew's Hospital; 47, Queen Anne street, Cavendish square. *Trans.* 2. *Sci. Com.*

1852 *Canney, George, M.D., Bishop-Auckland, Darlington, Durham.

1847 Carlill, John Burford, M.D., 42, Weymouth street, Portland place.

1853 Carter, Robert Brudenell, Ophthalmic Surgeon to, and Lecturer on Ophthalmic Surgery at, St. George's Hospital; Surgeon to the Royal South London Ophthalmic Hospital; 69, Wimpole street, Cavendish square, W.

1845 Cartwright, Samuel, Professor of Dental Surgery at King's College, London; Surgeon-Dentist to King's College Hospital; 32, Old Burlington street. C. 1860–1. *Sci. Com.*

1868 Cavafy, John, M.B. Lond., Medical Registrar and Lecturer on Comparative Anatomy at St. George's Hospital; 5, Whitehall.

1845 Chalk, William Oliver, 3, Nottingham terrace, York gate, Regent's park.

1844 Chambers, Thomas King, M.D., *Librarian*, Hon. Physician to H.R.H. the Prince of Wales; Consulting Physician to, and Lecturer on Medicine at, St. Mary's Hospital; Consulting Physician to the Lock Hospital; 64, Brook street, Grosvenor square. C. 1861. V.P. 1867. L. 1869-70. *Trans.* 1.

Elected

1859 Chance, Frank, M.D., Croft Lodge, Cambridge.

1849 Chapman, Frederick, Old Friars, Richmond green, Surrey.

1837 †Chapman, Henry Thomas, 21, Lower Seymour street, Portman square. C. 1858.

1868 Cheadle, Walter Butler, M.D., Assistant-Physician to, and Lecturer on Materia Medica at, St. Mary's Hospital; Assistant-Physician to the Hospital for Sick Children; 2, Hyde park place, Cumberland gate.

1865 Cholmeley, William, M.D., Physician to the Great Northern Hospital; 40, Russell square.

1866 Church, William Selby, M.D., Assistant-Physician to, and Lecturer on Comparative Anatomy at, St Bartholomew's Hospital; 2, Upper George street, Bryanston square.

1860 Clark, Andrew, M.D., Physician to, and Lecturer on Medicine at, the London Hospital; 16, Cavendish square.

1839 †Clark, Frederick Le Gros, Surgeon to, and Lecturer on Surgery at, St. Thomas's Hospital; Examiner in Surgery at the University of London; 14, St. Thomas's street, Southwark, and Lee, Kent. S. 1847-9. V.P. 1855-6. *Trans.* 3.

1848 Clarke, John, M.D., Obstetric Physician to, and Lecturer on Midwifery at, St. George's Hospital; Physician to the General Lying-in Hospital; 42, Hertford street, May fair. C. 1866.

1866 Clarke, William Fairlie, M.A. (Oxon.), Assistant-Surgeon to the West London Hospital, and to the Central London Ophthalmic Hospital; 1, Curzon street, May fair.

1861 *Clarke, William James, Surgeon to the Huddersfield Infirmary; John-William street, Huddersfield, Yorkshire.

1850 Clarkson, Josiah, New Hall street, Birmingham. *Trans.* 1.

Elected

1842 Clayton, Oscar Moore Passey, Extra Surgeon-in-Ordinary to H.R.H. the Prince of Wales, and Surgeon-in-Ordinary to H.R.H. the Duke of Edinburgh; 5, Harley street. C. 1865.

1853 Clover, Joseph Thomas, 3, Cavendish place, Cavendish square.

1857 Coates, Charles, F.R.C.P. Edinb., Physician to the Bath United General Hospital; 10, Circus, Bath.

1851 Cock, Edward, Senior Surgeon to, and Lecturer on Clinical Surgery at, Guy's Hospital; Consulting Surgeon to the Asylum for Deaf and Dumb; 36, Dean street south, Tooley street, Southwark. C. 1857. *Trans.* 3.

1868 Cockle, John, M.D., F.L.S., Physician to the Royal Free Hospital; 7, Suffolk place, Pall Mall. *Trans.* 2.

1850 Cohen, Daniel Whitaker, M.D., South Bank, North Down lane, Bideford, Devon.

1818 Cole, Robert, F.L.S., Holybourne, Hampshire.

1854 Collins, Frederick, M.D., Wanstead Lodge, Essex.

1867 Cooke, T. C. Weeden, Surgeon to the Cancer Hospital; 76, Upper Berkeley street, Portman square.

1840 *Cooke, William Robert, 2, Carlton villas, Hencroft street, Slough.

1865 Cooper, Alfred, Additional Surgeon for Out-patients to the Lock Hospital; Assistant-Surgeon to St. Mark's Hospital; Junior Surgeon to the West London Hospital; 70, Jermyn street, Piccadilly.

1819 Cooper, George, Brentford, Middlesex.

1841 Cooper, George Lewis, one of the Surgeons to the National Vaccine Institution, and Teacher of Vaccination to the Medical School of University College; Surgeon to the Bloomsbury Dispensary; 7, Woburn place, Russell square. C. 1860-1. *Trans.* 1.

1843 Cooper, William White, Surgeon-Oculist in Ordinary to H.M. the Queen; Consulting Ophthalmic Surgeon to St. Mary's Hospital; 19, Berkeley square. C. 1858-9.

Elected

1841 Coote, Holmes, Surgeon to, and Lecturer on Surgery at, St. Bartholomew's Hospital; 52, Margaret street, Regent street. S. 1853-4. C. 1864-5. *Trans.* 2.

1835 Copeland, George Ford, 5, Bayshill villas, Cheltenham.

1868 Cornish, William Robert, Surgeon, Madras Army: Secretary to the Inspector-General, Indian Medical Department.

1860 *Corry, Thomas Charles Steuart, M.D., Surgeon to the Belfast General Dispensary; 9, Clarendon place, Belfast.

1839 *Corsellis, Charles Cæsar, M.D., F.L.S., Benson, Oxon.

1853 Cory, William Gillett, M.D.

1847 Cotton, Richard Payne, M.D., Physician to the Hospital for Consumption and Diseases of the Chest; 46, Clarges street, Piccadilly. C. 1863.

1828 †Coulson, William, F.L.S., Consulting Surgeon to St. Mary's Hospital, and to the German Hospital; 2, Frederick's place, Old Jewry, and 1, Chester terrace, Regent's park. C. 1831. L. 1832-7. V.P. 1851-2. *Trans.* 1.

1864 Coulson, Walter John, Surgeon to the Lock Hospital, 29, St. James's place.

1860 †Couper, John, Surgeon to the London Hospital; Assistant-Surgeon to the Royal London Ophthalmic Hospital; 80, Grosvenor street.

1862 Cowell, George, Assistant-Surgeon to the Westminster Hospital; Surgeon to the Victoria Hospital for Children; 65, Belgrave road, Pimlico.

1841 Crawford, Mervyn Archdall Nott, M.D., Wiesbaden. C. 1853-4.

1868 Crawford, Thomas, M.D., Deputy Inspector-General of Hospitals (India); 6, Whitehall yard.

1869 *Cresswell, Pearson R., Dowlais, Merthyr Tydvil.

1847 Critchett, George, Surgeon to the Royal London Ophthalmic Hospital, Moorfields; 21, Harley street, Cavendish square. C. 1865. *Trans.* 1.

Elected

1868 Croft, John, Assistant-Surgeon to St. Thomas's Hospital; the Hospital, Newington.

1862 Crompton, Samuel, M.D., Physician to the Salford Royal Hospital and Dispensary; 69, Piccadilly, Manchester.

1837 Crookes, John Farrar, 5, Waterloo crescent, Dover.

1860 Cross, Richard, M.D., 5, Queen street, Scarborough.

1849 *Crowfoot, William Edward, Beccles, Suffolk.

1851 Cumming, James Cameron, M.D., 1, Cadogan place, Sloane street.

1865 Curgenven, J. Brendon, 11, Craven hill gardens, Bayswater.

1846 Curling, Henry, Surgeon to the Margate Royal Sea-Bathing Infirmary, and the Ramsgate Seamen's Infirmary; Ramsgate, Kent.

1837 †Curling, Thomas Blizard, F.R.S., Consulting-Surgeon to the London Hospital; 39, Grosvenor street. S. 1845-6. C. 1850. T. 1854-7. V.P. 1859. *Trans.* 13. *Pro.* 1. *Sci. Com.*

1847 Currey, John Edmund, M.D., Lismore, County Waterford.

1822 Cusack, Christopher John, Chateau d'Eu, France.

1852 Cutler, Thomas, M.D., Spa, Belgium.

1836 *Daniel, James Stock, Ramsgate, Kent.

1848 Daubeny, Henry, San Remo, Italy.

1846 Davies, Frederick, M.D., 124, Gower street, Bedford square.

1847 Davies, John, M.D., Physician-Extraordinary to the Hertford General Infirmary, and Visiting Physician to the Hadham Palace Lunatic Asylum, Hertford.

1853 Davies, Robert Coker Nash, Rye, Sussex.

1852 Davies, William, M.D., 10, Gay street, Bath.

1852 Davis, John Hall, M.D., Physician Accoucheur to, and Lecturer on Midwifery at, the Middlesex Hospital; Physician to the Royal Maternity Charity, and Consulting Physician-Accoucheur to the St. Pancras Infirmary; 24, Harley-street, Cavendish square. C. 1869-70.

1818 Dawson, James, Wray Castle, Windermere.

Elected

1847 Day, George Edward, M.D., F.R.S., Emeritus Professor of Medicine in the University of St. Andrew's; Furzewell House, Torquay.

1867 Day, William Henry, M.D., Physician to the Margaret street Dispensary for Consumption; 10, Manchester square.

1867 De Meric, Victor, Surgeon to the Royal Free Hospital, and to the German Hospital, Dalston; 52, Brook street, Grosvenor square.

1846 *Denton, Samuel Best, M.D., Ivy Lodge, Hornsea, Hull.

1859 Dickinson, William Howship, M.D., Assistant-Physician to, and Lecturer on Materia Medica at, St. George's Hospital; Physician to the Hospital for Sick Children; 11, Chesterfield street, May fair. *Trans.* 10. *Sci. Com.*

1844 Dickson, Robert, M.D., F.L.S. C. 1860.

1839 †Dixon, James, Consulting Surgeon to the Royal London Ophthalmic Hospital, Moorfields; Consulting Ophthalmic Surgeon to the Asylum for Idiots; 29, Lower Seymour street, Portman Square. L. 1849-55. V.P. 1857-8. T. 1863-4. C. 1866-7. *Trans.* 4.

1862 Dobell, Horace B., M.D., Physician to the Royal Hospital for Diseases of the Chest, City road; 84, Harley street. *Trans.* 1.

1845 Dodd, John.

1857 Douglas, Archibald, M.D., 8, Clifton place, Sussex square, Hyde park.

1863 Down, John Langdon Haydon, M.D., Physician to, and Lecturer on Materia Medica and Therapeutics at, the London Hospital; 39, Welbeck street, Cavendish square. *Trans.* 2.

1867 Drage, Charles, M.D., Hatfield, Herts.

1853 Druitt, Robert, M.R.C.P., 37, Hertford street, May fair. *Trans.* 2.

1865 Drysdale, Charles Robert, M.D., Physician to the Farringdon Dispensary; Assistant-Physician to the Metropolitan Free Hospital; 99, Southampton row, Russell square.

Elected

1865 Duckworth, Dyce, M.D., Assistant-Physician to St. Bartholomew's Hospital; 11, Grafton street, Bond street.

1845 Duff, George, M.D., High street, Elgin.

1845 Duffin, Edward Willson, 18, Devonshire street, Portland place. *Trans.* 1.

1867 Dukes, M. Charles, M.D., High House, Enfield Highway.

1833 †Dunn, Robert, 31, Norfolk street, Strand. C. 1845-6. *Trans.* 2.

1861 Du Pasquier, Claudius Francis, Surgeon-Apothecary to H.M. the Queen, and to the Household of H.R.H. the Prince of Wales; 62, Pall Mall.

1863 Durham, Arthur Edward, F.L.S., Assistant-Surgeon to, and Lecturer on Anatomy at, Guy's Hospital; 82, Brook street, Grosvenor square. *Trans.* 2. *Sci. Com.*

1843 Durrant, Christopher Mercer, M.D., Physician to the East Suffolk and Ipswich Hospital; Ipswich, Suffolk.

1839 Dyer, Henry Sumner, M.D., Sennowe Hall, Guist, Norfolk. C. 1854-5.

1836 Earle, James William, late of Norwich.

1868 Eastes, George, M.B. Lond., 5, Albion place, Hyde park square.

1824 Edwards, George.

1823 Egerton, Charles Chandler, Kendall Lodge, Epping.

1869 Elam, Charles, M.D., 18, Harley street, Cavendish square.

1861 *Elliot, Robert, M.D., Physician to the Carlisle Dispensary; 35, Lowther street, Carlisle.

1848 Ellis, George Viner, Professor of Anatomy in University College, London. C. 1863-4. *Trans.* 2.

1868 Ellis, James, M.D., 2, Langton villas, St. John's road, Blackheath, and Infirmary, St. Pancras Workhouse.

1854 *Ellison, James, M.D., Surgeon-in-Ordinary to the Royal Household, Windsor; 14, High street, Windsor.

1835 England, William, M.D., Ipswich, Suffolk.

1842 Erichsen, John Eric, Professor of Clinical Surgery in University College, London, and Surgeon to University College Hospital; 6, Cavendish place, Cavendish square. C. 1855-6. V.P. 1868. *Trans.* 2.

1836 Evans, George Fabian, M.D., Birmingham.

Elected

1815 *Evans, Griffith Francis Dorsett, M.D.; Crescent, Shrewsbury. C. 1838.

1845 Evans, William Julian, M.D., Pinner, Middlesex.

1864 Fagge, Charles Hilton, M.D., Assistant-Physician to, and Lecturer on Hygiene at, Guy's Hospital; 11, St. Thomas's street, Southwark. *Trans.* 2.

1869 Fairbank, Frederick Royston, M.D., Lynton, North Devon.

1858 Falconer, Randle Wilbraham, M.D., Physician to the Bath United Hospital; 22, Bennett street, Bath.

1862 Farquharson, Robert, M.D., Medical Officer, Rugby School; Horton crescent, Rugby, Warwickshire.

1844 Farre, Arthur, M.D., F.R.S., Physician-Accoucheur to H.R.H. the Princess of Wales; 12, Hertford street, May fair. C. 1857. V.P. 1864. *Sci. Com.*

1863 Fenwick, Samuel, M.D., Assistant-Physician to, and Lecturer on Histology at, the London Hospital; 29, Harley street, Cavendish square. *Trans.* 3.

1841 Fergusson, Sir William, Bart., F.R.S., Sergeant-Surgeon to H.M. the Queen; Surgeon to King's College Hospital; 16, George street, Hanover square. C. 1849-50. V.P. 1863-4 *Trans.* 4.

1852 *Field, Alfred George, Surgeon to St. Mary's Hospital, Brighton; 22, Denmark Terrace, Montpelier road, Brighton.

1849 Fincham, George Tupman, M.D., Physician to, and Lecturer on Clinical Medicine at, the Westminster Hospital; 13, Belgrave road, Pimlico.

1866 Fish, John Crockett, B.A., M.B., Camb., Physician to the Royal Hospital for Diseases of the Chest, City Road; 92, Wimpole street, Cavendish square.

1836 †Fisher, Sir John William, 5, Grosvenor gate. C. 1843-4.

1860 Fitzgerald, Thomas George, Staff-Surgeon; 6, Whitehall yard.

1866 Fitzpatrick, Thomas, M.D., M.A., Dublin; Physician to the Western General Dispensary, 30, Sussex gardens, Hyde park.

Elected

1842 FLETCHER, THOMAS BELL ELCOCK, M.D., Physician to the Birmingham General Hospital; 7, Waterloo street, Birmingham. *Trans.* 1.

1864 *FOLKER, WILLIAM HENRY, Surgeon to the North Staffordshire Infirmary; 25, Market street, Hanley, Staffordshire.

1848 FORBES, JOHN GREGORY, 82, Oxford terrace, Hyde park. C. 1868-9. *Trans.* 2.

1852 †FORSTER, JOHN COOPER, Surgeon to, and Lecturer on Surgery at, Guy's Hospital; 29, Upper Grosvenor street. C. 1868-9. *Pro.* 1.

1865 FOSTER, BALTHAZAR WALTER, M.D., Professor of Medicine at the Queen's College, Birmingham, and Physician to the Birmingham General Hospital; 4, Old square, Birmingham, and Grosvenor house, Edgbaston.

1859 FOX, EDWARD LONG, M.B., Physician to the Bristol Royal Infirmary, and Lecturer on Medicine at the Bristol School of Medicine; Church House, Clifton, Gloucestershire.

1858 *FOX, WILSON, M.D., Physician-Extraordinary to H.M. the Queen; Professor of Clinical Medicine in University College, London, and Physician to University College Hospital; 67, Grosvenor street. *Trans.* 2.

1843 FRASER, PATRICK, M.D. C. 1866.

1868 FREEMAN, WILLIAM HENRY, 29, Spring gardens.

1836 †FRENCH, JOHN GEORGE, Surgeon to the St. James's Infirmary; 41, Great Marlborough street. C. 1852-3.

1849 FRERE, ROBERT TEMPLE, M.A., F.R.C.P., 143, Harley street.

1846 FULLER, HENRY WILLIAM, M.D., Physician to St. George's Hospital; 13, Manchester square. C. 1862. S. 1864-5. V.P. 1868-9. *Trans.* 3.

1864 *GAIRDNER, WILLIAM TENNANT, M.D., Professor of the Practice of Medicine in the University of Glasgow; Physician to the Glasgow Royal Infirmary; 225, St. Vincent Street, Glasgow.

1865 GANT, FREDERICK JAMES, Surgeon to the Royal Free Hospital; 16, Connaught square, Hyde park. *Trans.* 1.

Elected

1867 Garland, Edward Charles, L.R.C.P. Edin., Yeovil, Somerset.

1867 Garlike, Thomas W., Tulse Hill, Brixton.

1854 Garrod, Alfred Baring, M.D., F.R.S., Professor of Materia Medica in King's College, London, and Physician to King's College Hospital; Examiner in Materia Medica at the University of London; 11, Harley street, Cavendish square. C. 1867. *Trans.* 8.

1857 Gascoyen, George Green, Surgeon to the Lock Hospital; Assistant-Surgeon to, and Lecturer on Anatomy at, St. Mary's Hospital; 48, Queen Anne street, Cavendish square. S. 1866-69. *Trans.* 3. *Sci. Com.* 2.

1851 Gaskoin, George, 7, Westbourne park.

1819 Gaulter, Henry.

1848 Gay, John, Senior Surgeon to the Great Northern Hospital, and Consulting Surgeon to the Asylum for Idiots; 10, Finsbury place south.

1866 Gee, Samuel Jones, M.D., Assistant-Physician to St. Bartholomew's Hospital; Assistant-Physician to the Hospital for Sick Children; 54, Harley street, Cavendish square.

1821 *George, Richard Francis, 20, Marlborough buildings, Bath.

1858 Godfrey, Benjamin, M.D., Carlton House, Enfield, Middlesex.

1870 Godson, Clement, Surgeon-Accoucheur to the City of London Lying-in Hospital; 74, Park street, Grosvenor square.

1867 Goodeve, Edward, M.B., Hon. Physician to H.M. the Queen; late Surgeon-Major, H.M.'s Bengal army.

1851 Goodfellow, Stephen Jennings, M.D., Physician to the Middlesex Hospital; 5, Savile row, Burlington gardens. C. 1864-5. *Trans.* 2.

1818 Gordon, James Alexander, M.D., F.R.S., Pixholme, near Dorking, Surrey. C. 1828. V.P. 1829. *Trans.* 1.

1862 Goulstone, John Griffith, M.D., 30, Clarence street, Liverpool.

Elected

1851 Gowland, Peter Yeames, Surgeon to St. Mark's Hospital; 34, Finsbury square.

1844 Grantham, John, Crayford, Kent.

1846 Gream, George Thompson, M.D., Physician-Accoucheur to H.R.H. the Princess of Wales; 2, Upper Brook street, Grosvenor square. C. 1863.

1868 Green, Thomas Henry, M.D., Assistant-Physician to, and Lecturer on Pathology at, Charing Cross Hospital; 74, Wimpole street, Cavendish square.

1843 Greenhalgh, Robert, M.D., Physician-Accoucheur to, and Lecturer on Midwifery at, St. Bartholomew's Hospital; Consulting Physician to the Samaritan Free Hospital for Women and Children, and to the City of London Lying-in Hospital; 72, Grosvenor street.

1860 Greenhow, Edward Headlam, M.D., F.R.S., Examiner in Forensic Medicine at the University of London; Physician to, and Lecturer on Public Health and on Medical Jurisprudence at, the Middlesex Hospital; and Consulting Physician to the Western General Dispensary; 77, Upper Berkeley Street, Portman square. *Trans.* 2.

1868 Grigg, William Chapman, Edinburgh.

1814 Grove, John, M.D., Salisbury.

1852 Grove, John, Spring Grove, Hampton, Middlesex.

1860 Gueneau de Mussy, Henri, M.D., Physician to the French Hospital, Lisle street, Leicester square; 55, Wimpole street, Cavendish square.

1849 Gull, William Withey, M.D., D.C.L., F.R.S., Member of the Senate of the University of London; 74, Brook street, Grosvenor square. C. 1864. *Trans.* 3.

1837 Gully, James Manby, M.D., Great Malvern, Worcestershire.

1854 Habershon, Samuel Osborne, M.D., Physician to, and Lecturer on Materia Medica and Therapeutics at, Guy's Hospital; Examiner in Materia Medica at the University of London; 70, Brook street, Grosvenor square. S. 1867. C. 1869-70. *Trans.* 3.

1849 Hailey, Hammett, F.L.S., Newport Pagnell, Bucks.

Elected

1848 Halley, Alexander, M.D., F.G.S., 16, Harley street, Cavendish square.

1870 Hamilton, Robert, Surgeon to the South Hospital, Liverpool; 1, Prince's road, Liverpool.

1819 †Hammerton, Thomas, Carlton Lawn, Carlton street, Cheltenham. C. 1829-30.

1838 †Hancock, Henry, Surgeon to the Charing Cross Hospital; Surgeon to the Royal Westminster Ophthalmic Hospital; 76, Harley street, Cavendish square. C. 1851. V.P. 1869.

1848 *Harcourt, George, M.D., Chertsey, Surrey.

1836 Harding, John Fosse, Mount Sandford, Southborough, Tunbridge Wells. C. 1858-9.

1856 Hare, Charles John, M.D., late Professor of Clinical Medicine in University College, London, and Physician to University College Hospital; 57, Brook street, Grosvenor square.

1857 Harley, George, M.D., F.R.S., 25, Harley street, Cavendish square. *Trans.* 1. *Sci. Com.* 2.

1864 Harley, John, M.D., F.L.S., Assistant-Physician to the London Fever Hospital; 78, Upper Berkeley street, Portman square. *Trans.* 3.

1866 Harper, Philip H., 30, Cambridge street, Hyde park.

1859 Harris, Francis, M.D., F.L.S., Physician to St. Bartholomew's Hospital; 24, Cavendish square.

1870 Harrison, Reginald, Assistant-Surgeon to the Liverpool Royal Infirmary, and Lecturer on Anatomy at the School of Medicine; 51, Rodney street, Liverpool.

1841 Harvey, William, Surgeon to the Royal Dispensary for Diseases of the Ear, and to the Freemasons' Female Charity; Aural Surgeon to the Great Northern Hospital; 2, Soho square. C. 1854.

1854 Haviland, Alfred, late Surgeon to the Bridgewater Infirmary; 120, King Henry's road, Primrose hill.

1870 Haward, J. Warrington, Assistant-Surgeon to the Hospital for Sick Children; 46, Queen Anne street, Cavendish square.

Elected

1828 †Hawkins, Cæsar Henry, F.R.S., Sergeant-Surgeon to H.M. the Queen, and Consulting Surgeon to St. George's Hospital; 26, Grosvenor street. C. 1830-1, 1860. V.P. 1838-9. T. 1841-4. P. 1855-6. *Trans.* 12.

1838 †Hawkins, Charles, Inspector of Anatomical Schools in London; 27, Savile row, Burlington gardens. C. 1846-7. S. 1850. V.P. 1858. T. 1861-2. *Trans.* 2.

1848 Hawksley, Thomas, M.D., Physician to the Margaret street Dispensary for Consumption and Diseases of the Chest; 6, Brook street, Hanover square.

1860 Hayward, Henry Howard, Assistant Surgeon-Dentist to St. Mary's Hospital; Dental Surgeon to the Hospital for Consumption, Brompton; 38, Harley street, Cavendish square.

1861 Hayward, William Henry, Church House, Oldbury, Worcestershire.

1848 *Heale, James Newton, M.D., Winchester, Hants.

1865 Heath, Christopher, Assistant-Surgeon to University College Hospital; and Teacher of Operative Surgery in University College, London; 9, Cavendish place, Cavendish square.

1850 Heaton, George, M.D., Boston, U.S.

1829 †Heberden, Thomas, M.D., 98, Park street, Grosvenor square.

1844 Hennen, John, M.D. L. 1848-50.

1849 Henriques, Amos, M.D., Hon. Physician to the Spanish Embassy; 67, Upper Berkeley street, Portman square.

1821 Herberski, Vincent, M.D., Professor of Medicine in the University of Wilna.

1843 Hewett, Prescott Gardner, Surgeon-Extraordinary to H.M. the Queen; Surgeon to St. George's Hospital; 1, Chesterfield street, May fair. C. 1859. V.P. 1866-7. *Trans.* 7. *Sci. Com.*

1855 Hewitt, Graily, M.D., Professor of Midwifery in University College, London, and Obstetric Physician to University College Hospital; Examiner in Midwifery at the University of London; 36, Berkeley square.

Elected

1853 Hewlett, Thomas, Surgeon to Harrow School; Harrow, Middlesex. *Trans.* 1.

1868 Hill, John Daniel, Surgeon to the Royal Free Hospital; Assistant-Surgeon to the Royal Orthopædic Hospital; 17, Guilford street, Russell square.

1862 Hill, M. Berkeley, M.B. Lond., Assistant-Surgeon to University College Hospital; Surgeon to the Lock Hospital; 14, Weymouth street, Portland place.

1867 Hill, Samuel, M.D., 22, Mecklenburgh square.

1842 Hillman, William Augustus, Surgeon to the Westminster Hospital; 1, Argyll street, Regent street. C. 1858-9.

1841 †Hilton, John, F.R.S., Surgeon-Extraordinary to H.M. the Queen; Consulting Surgeon to Guy's Hospital; Consulting Surgeon to the Royal General Dispensary, St. Pancras; 10, New Broad street, City. C. 1851. V.P. 1863-4. *Trans.* 4.

1868 Hinton, James, Aural Surgeon to Guy's Hospital; 18, Savile Row. *Trans.* 2.

1859 Hird, Francis, Surgeon to the Charing Cross Hospital; 13, Old Burlington street.

1861 *Hoffmeister, William Carter, M.D., Surgeon to H.M. the Queen in the Isle of Wight; Clifton House, Cowes, Isle of Wight.

1843 Holden, Luther, Surgeon to, and Lecturer on Anatomy at, St. Bartholomew's Hospital; Consulting Surgeon to the Metropolitan Dispensary; Surgeon to the Foundling Hospital; 65, Gower street, Bedford square. C. 1859. L. 1865.

1814 †Holland, Sir Henry, Bart., M.D., D.C.L., LL.D., F.R.S., Physician in Ordinary to H.M. the Queen; 72, Brook street, Grosvenor square. C. 1817, 1833-4. V.P. 1826, 1840. *Trans.* 1.

1868 Hollis, William Ainslie, M.A., M.B. Camb., Physician to Casualty Department, St. Bartholomew's Hospital; 53, Harley street, Cavendish square.

1861 Holman, William Henry, M.B., Lond., 68, Adelaide road south, Hampstead.

Elected

1856 Holmes, Timothy, Surgeon to, and Lecturer on Surgery at, St. George's Hospital; Surgeon in Chief to the Metropolitan Police Force; 31, Clarges street, Piccadilly. C. 1869-70. *Trans.* 4. *Sci. Com.*

1846 Holt, Barnard Wight, Senior Surgeon to, and Lecturer on Clinical Surgery at, the Westminster Hospital; Medical Officer of Health for Westminster; 14, Savile row, Burlington Gardens. C. 1862-63.

1846 Holthouse, Carsten, Surgeon to, and Lecturer on Surgery at, the Westminster Hospital; 3, George Street, Hanover square. C. 1863.

1865 Howard, Benjamin, M.D., Lecturer on Operative Surgery, and Surgeon to the Long Island College Hospital, New York; 327, West 23rd street, New York.

1865 Howard, Edward, M.D., Oaklands, Penge, Surrey.

1868 Hubbard, John Waddington, 16, Kensington square.

1857 Hulke, John Whitaker, F.R.S., Surgeon to, and Lecturer on Ophthalmic Surgery at, the Middlesex Hospital; Surgeon to the Royal London Ophthalmic Hospital, Moorfields; Lecturer on Anatomy and Physiology to the Royal College of Surgeons; 10, Old Burlington street. *Trans.* 4. *Sci. Com.*

1857 Hulme, Edward Charles, Ophthalmic Surgeon to the Great Northern Hospital; Woodbridge road, Guildford. *Trans.* 1,

1844 Humby, Edwin, M.D., 83, Hamilton terrace, St. John's wood. C. 1866-7

1855 Humphry, George Murray, M.D., F.R.S., Surgeon to Addenbrooke's Hospital; Professor of Human Anatomy and Physiology in the Cambridge University Medical School; Cambridge. *Trans.* 5.

1866 Hunter, Charles, 30, Wilton place, Belgrave square.

1849 Hussey, Edward Law, Senior Surgeon to the Radcliffe Infirmary, and Consulting Surgeon to the County Lunatic Asylum and the Warneford Asylum; 8, St. Aldate's, Oxford. *Trans.* 1.

Elected

1856 Hutchinson, Jonathan, Surgeon to, and Lecturer on Surgery at, the London Hospital; Assistant-Surgeon to the Royal London Ophthalmic Hospital, Moorfields; 4, Finsbury Circus. C. 1870. *Trans.* 2. *Pro.* 2

1820 Hutchinson, William, M.D.

1840 Hutton, Charles, M.D., Senior Physician to the General Lying-in Hospital; 26, Lowndes street, Belgrave square. C. 1858-9.

1866 Iles, Francis Henry Wilson, M.D., Watford, Herts.

1847 Image, William Edmund, Senior Surgeon to the Suffolk General Hospital; Bury St. Edmund's, Suffolk. *Trans.* 1.

1856 Inglis, Cornelius, M.D., 9, Duke street, Portland place.

1841 †Jackson, Paul, 24, Wimpole street, Cavendish square. C. 1862.

1868 Jackson, Thomas Carr, Surgeon to the Great Northern Hospital, and Surgeon to the National Orthopædic Hospital; 3, Weymouth street, Portland place.

1863 Jackson, Thomas Vincent, Surgeon to the South Staffordshire General Hospital; Darlington st., Wolverhampton.

1841 Jacobovics, Maximilian Moritz, M.D., Vienna.

1825 James, John B., M.D.

1839 Jeffreys, Julius, F.R.S., Drymona, Belvidere road south, Upper Norwood, Surrey.

1840 *Jenks, George Samuel, M.D., 18, Circus, Bath.

1851 Jenner, Sir William, Bart., M.D., D.C.L., F.R.S., Physician in Ordinary to H.M. the Queen, and to H.R.H. the Prince of Wales; Professor of Clinical Medicine in University College, London, and Physician to University College Hospital; 63, Brook street, Grosvenor square. C. 1864. *Trans.* 3.

1848 Johnson, Athol Archibald Wood, 20, Regency square, Brighton. *Trans.* 1.

1851 Johnson, Edmund Charles, Corresponding Member of the Medical and Philosophical Society of Florence, and of "l'Institut Genevois."

Elected

1847 Johnson, George, M.D., *Vice-President,* Professor of the Principles and Practice of Medicine in King's College, London, and Physician to King's College Hospital; Member of the Senate of the University of London; 11, Savile row, Burlington gardens. C. 1862-4. V.P. 1870. *Trans.* 8.

1868 Johnston, William, M.D., 44, Princes square, Hyde park.

1862 Jones, Charles Handfield, M.B., F.R.S., Physician to, and Lecturer on Medicine at, St. Mary's Hospital; 49, Green street, Grosvenor square.

1844 †Jones, Henry Bence, M.A., M.D., D.C.L., F.R.S., Consulting Physician to St. George's Hospital; 84, Brook street, Grosvenor square. C. 1855-6. V.P. 1866. *Trans.* 11.

1835 †Jones, Henry Derviche, 12, Norfolk crescent, Oxford square. C. 1854-5.

1837 †Jones, Thomas William, M.D., 55, St. John's Park, Upper Holloway. C. 1858.

1859 Jones, William Price, M.D., Claremont road, Surbiton, Kingston.

1865 Jordan, Furneaux, Surgeon to the Queen's Hospital, and Professor of Surgery at the Queen's College, Birmingham; 16, Colmore row, Birmingham.

1816 *Kauffmann, George Hermann, M.D., Hanover.

1848 *Kendell, Daniel Burton, M.D., Westwood park, Scarborough, Yorkshire.

1847 Keyser, Alfred, 21, Norfolk crescent, Oxford square.

1857 Kiallmark, Henry Walter, 66, Princes square, Bayswater.

1851 Kingdon, John Abernethy, Surgeon to the City of London Truss Society, and to the City Dispensary; 2, New Bank buildings, Lothbury. C. 1866-7. *Trans.* 1. *Sci. Com.*

1855 Lane, James Robert, Surgeon to, and Lecturer on Surgery at, St. Mary's Hospital; Surgeon to the Lock Hospital; 2, Berkeley street, Piccadilly. C. 1870. *Trans.* 1.

Elected

1840 Lane, Samuel Armstrong, Surgeon to, and Lecturer on Clinical Surgery at, St. Mary's Hospital; Consulting Surgeon to the Lock Hospital; 2, Berkeley street, Piccadilly. C. 1849-50. V.P. 1865.

1865 Langton, John, Assistant-Surgeon to, and Demonstrator of Anatomy at, St. Bartholomew's Hospital; Surgeon to the City of London Truss Society; the College, St. Bartholomew's Hospital.

1841 *Lashmar, Charles, M.D., 83, North End, Croydon, Surrey.

1862 Latham, Peter Wallwork, M.A., M.B., Physician to Addenbrooke's Hospital, Cambridge; Examiner for Medical Degrees in Cambridge University; 17, Trumpington street, Cambridge.

1816 Lawrence, G. E.

1840 Laycock, Thomas, M.D., F.R.S.E., Physician-in-Ordinary to H.M. the Queen in Scotland, Professor of the Practice of Medicine and of Clinical Medicine, and Lecturer on Psychology and Mental Diseases in the University of Edinburgh; 13, Walker street, Edinburgh.

1843 *Leach, Jesse, Moss Hall, Heywood, Lancashire.

1868 Leared, Arthur, M.D., Senior Physician to the Great Northern Hospital; 12, Old Burlington street.

1822 Ledsam, John Joseph, M.D., 17, Esplanade, Scarborough, Yorkshire.

1843 Lee, Henry, Surgeon to St. George's Hospital; 9, Savile row, Burlington gardens. C. 1856-7. L. 1863-4. V.P. 1868-9 *Trans.* 11. *Pro.* 1. *Sci. Com.*

1822 †Lee, Robert, M.D., F.R.S., Corresponding Member of the Imperial Academy of Medicine, Paris; 4, Savile row, Burlington gardens. C. 1829, 1834. S. 1830-3 V. P. 1835. *Trans.* 27.

1869 Legg, John Wickham, M.D., Physician to Casualty Department, St. Bartholomew's Hospital; 11, South street, Park lane.

1836 Leighton, Frederick, M.D. Frankfort-on-the-Maine.

1806 Lind, John, M.D.

1870 Livingston, John, M.D., New Barnet, Hertfordshire.

Elected

1819 Lloyd, Robert, M.D.

1820 Locher, J. G., M.C.D., Town Physician of Zurich. *Trans.* 2.

1824 †Locock, Sir Charles, Bart., M.D., D.C.L., F.R.S., Member of the Senate of the University of London; 26, Hertford street, May fair. C. 1826. V.P. 1841. P. 1857-8. *Trans.* 1.

1846 Lomax, Henry Thomas, Surgeon to the County Police; St. Mary's Grove, Stafford.

1860 Longmore, Thomas, C.B., Hon. Surgeon to H.M. the Queen, Deputy Inspector-General, and Professor of Clinical and Military Surgery, New Army Medical School, Royal Victoria Hospital, Netley, Southampton; Woolston Lawn, Woolston, Hants. *Trans.* 2.

1836 Löwenfeld, Joseph S., M.D., Berbice.

1852 Luke, James, F.R.S., Consulting Surgeon to the London Hospital; Woolley Lodge, Maidenhead Thicket, Berks. C. 1858. *Trans.* 4.

1857 Lyon, Felix William, M.D., 18, Buccleuch Place, Edinburgh.

1867 Maberly, George Frederick, Leamington, Warwickshire.

1867 *Mac Cormac, William, M.A., M.D., Surgeon to the Belfast General Hospital; 4, Howard street, Belfast.

1862 *M'Donnell, Robert, M.D., F.R.S., Surgeon to Steevens' Hospital; 14, Lower Pembroke street, Dublin. *Trans.* 1.

1846 M'Ewen, William, M.D., Surgeon to Chester Castle; 27, Nicholas street, Chester.

1866 Macgowan, Alexander Thorburn, Kingswood park, near Bristol.

1823 †Macilwain, George, Consulting Surgeon to the Finsbury Dispensary, and to the St. Anne's Society's Schools; 3, Albany Court yard. C. 1829-30. V.P. 1848. *Trans.* 1.

1822 Macintosh, Richard, M.D.

1859 *M'Intyre, John, M.D., Odiham, Hants.

Elected

1854 *Mackinder, Draper, M.D., Consulting Surgeon to the Dispensary, Gainsborough, Lincolnshire.

1860 Maclean, John, M.D., 24, Portman street, Portman square.

1849 Maclure, Duncan Maclachlan, M.B., Lecturer on Physiology at the Westminster Hospital; 34, Harley street, Cavendish square.

1842 Macnaught, John, M.D., 25, Bedford street, Liverpool.

1855 Marcet, William, M.D., F.R.S., Assistant-Physician to the Hospital for Consumption, Brompton; 48, Harley street. *Trans.* 2. *Sci. Com.*

1848 Markham, William Orlando, M.D., Poor Law Inspector for the Metropolitan District; 8, Harley street, Cavendish square. C. 1862-3. *Trans.* 2.

1867 Marsh, F. Howard, Demonstrator of Anatomy at St. Bartholomew's Hospital, and Assistant-Surgeon to the Hospital for Sick Children.

1838 Marsh, Thomas Parr, M.D.

1851 Marshall, John, F.R.S., Professor of Surgery in University College, London, and Surgeon to University College Hospital; 10, Savile Row, Burlington gardens. C. 1866. *Trans.* 2.

1841 Martin, Sir James Ranald, C.B., F.R.S., Examining Medical Officer to the Secretary of State for India in Council; President of Medical Board for Examination of Officers of H.M.'s Indian Medical Service; Inspector General of Hospitals; 37, Upper Brook street, Grosvenor square. C. 1853. V.P. 1862.

1853 Masfen, William Edward, Surgeon to the Staffordshire General Infirmary; Stafford.

1861 Mason, Francis, Assistant-Surgeon to, and Lecturer on Surgery at, the Westminster Hospital; 10, Conduit street, Regent street.

1869 Mayo, Charles, M.B., 10, Staple's inn, Holborn.

1837 Mayo, Thomas, M.D., F.R.S., the Retreat, Yarmouth, Isle of Wight. S. 1841. C. 1847-8. V.P. 1851-2.

1839 Meade, Richard Henry, Consulting Surgeon to the Bradford Infirmary; Bradford, Yorkshire. *Trans.* 1.

Elected

1870 Meadows, Alfred, M.D., Physician to the Hospital for Women, Soho square, Physician Accoucheur to the General Lying-in-Hospital, York Road; 27, George street, Hanover square.

1865 Medwin, Aaron George, M.D., Dental Surgeon to the Royal Kent Dispensary, 11, Montpellier row, Blackheath, Kent.

1867 Meredyth, Colomiati, M.D., 76, Margaret street, Cavendish square.

1837 Merriman, Samuel William John, M.D., Consulting Physician-Accoucheur to the Westminster General Dispensary; Marlboro' House, Sandown, Isle of Wight. C. 1851-2. *Trans.* 1.

1852 Merryweather, James, Consulting Surgeon to the National Dental Hospital; 25, Brook street, Grosvenor square.

1847 Meryon, Edward, M.D., F.G.S., 14, Clarges street, Piccadilly. L. 1859-60. C. 1864-5. V.P. 1868-9. *Trans.* 2.

1815 Meyer, Augustus, M.D., St. Petersburgh.

1868 Michell, William Daniel, 38, Delancey street, Gloucester gate, Regent's park.

1840 Middlemore, Richard, Consulting Surgeon to the Birmingham Eye Hospital; 19, Temple row, Birmingham.

1854 Middleship, Edward Archibald.

1860 *Miles, Herbert Chalmers, Surgeon in the Royal Horse Artillery, India [per John Miles, M.D., Carlisle villas, Eastbourne].

1818 *Miller, Patrick, M.D., F.R.S.E., Consulting Physician to the Devon and Exeter Hospital, and to St. Thomas's Hospital for Lunatics; the Grove, Exeter, Devonshire.

1863 Monro, Henry, M.D., Physician to St. Luke's Hospital; 13, Cavendish square. C. 1868.

1844 Montefiore, Nathaniel, 36, Hyde park gardens.

1836 Moore, George, M.D., Priory Houses, Hastings, Sussex.

Elected

1861 Morehead, Charles, M.D., Hon. Surgeon to H.M. the Queen; Deputy-Inspector General of Hospitals; 6, Chester street, Edinburgh.

1857 Morgan, John, 3, Sussex place, Hyde park gardens. *Trans.* 1.

1861 Morgan, John Edward, M.B., Physician to the Manchester Royal Infirmary, and Lecturer on Medicine at the Manchester Royal School of Medicine; 1, St. Peter's Square, Manchester.

1851 Mouat, Frederic John, M.D., Surgeon-Major, Bengal Army; late Inspector-General of Gaols in the Lower Provinces of the Bengal Presidency, and Member of the Senate of the University of Calcutta.

1868 Moxon, Walter, M.D., F.L.S., Assistant-Physician to, and Lecturer on Morbid Anatomy at, Guy's Hospital; 6, Finsbury circus.

1856 Murchison, Charles, M.D., LL.D. Edinb., F.R.S., Senior Physician to the London Fever Hospital; Physician to, and Lecturer on the Practice of Medicine at, the Middlesex Hospital; 79, Wimpole street, Cavendish square. C. 1870. *Trans.* 3.

1847 Murchison, Simon, Bicester, Oxon.

1863 Myers, Arthur B. R., Coldstream Guards' Hospital, Vincent square, Westminster.

1859 Nayler, George, Surgeon to the Hospital for Diseases of the Skin, Blackfriars; 3, Savile row, Burlington gardens.

1870 Neild, James Edward, M.D., Lecturer on Forensic Medicine in the University of Melbourne; 166, Collins street east, Melbourne, Victoria.

1835 †Nelson, Thomas Andrew, M.D., 10, Nottingham terrace, York gate, Regent's park.

1843 Newton, Edward, 4, Upper Wimpole street. C. 1863-4.

1868 Nicholls, James, M.D., Duke street, Chelmsford, Essex.

1849 Norman, Henry Burford, Portland Lodge, Southsea, Hants.

Elected

1847 *Nourse, William Edward Charles, Surgeon to the Brighton Children's Hospital; Surgeon to St. Mary's Hospital, Brighton; 11, Marlborough place, Brighton.

1849 Noverre, Arthur, 16, Park street, Grosvenor square. C. 1870.

1864 Nunn, Thomas William, Surgeon to, and Lecturer on Surgery at, the Middlesex Hospital; 8, Stratford place, Oxford street.

1870 Nunneley, Frederick Barham, M.D., Assistant-Physician to the City of London Hospital for Diseases of the Chest; Assistant-Physician to the Hospital for Sick Children; 28, Harley street, Cavendish square. *Trans.* 1.

1847 O'Connor, Thomas, March, Cambridgeshire.

1843 O'Connor, William, M.D., Senior Physician to the Royal Free Hospital; 30, Upper Montagu street, Montagu square.

1858 Ogle, John William, M.D., Physician to, and Lecturer on Pathology at, St. George's Hospital; 13, Upper Brook street, Grosvenor square. *Trans.* 4.

1855 *Ogle, William, M.A., M.D., Physician to the Derby Infirmary; 3, Stewart terrace, Derby.

1860 Ogle, William, M.D., *Secretary*, Assistant-Physician to, and Lecturer on Physiology at, St. George's Hospital; 34, Clarges street, Piccadilly. S. 1868-70. *Trans.* 2.

1870 Oldham, Charles Frederic, 10, Ladbroke road, Notting Hill, [and Grinlay and Co., Army Agents.]

1850 Oldham, Henry, M.D., Consulting Obstetric Physician to Guy's Hospital; 4, Cavendish place, Cavendish square. C. 1865. *Trans.* 1.

1846 *Ormerod, Edward Latham, M.D., Physician to the Sussex County Hospital; 14, Old Steine, Brighton. *Trans.* 2.

1847 *Page, William Bousfield, Surgeon to the Cumberland Infirmary; Carlisle. *Trans.* 2.

Elected

1840 †Paget, James, D.C.L., F.R.S., Sergeant-Surgeon Extraordinary to H.M. the Queen; Surgeon-in-Ordinary to H.R.H. the Prince of Wales; Surgeon to St. Bartholomew's Hospital; Surgeon to Christ's Hospital; Member of the Senate of the University of London; 1, Harewood place, Hanover square. C. 1848-49. V.P. 1861. T. 1867. *Trans.* 8. *Sci. Com.*

1858 *Paley, William, M.D., Physician to the Ripon Dispensary; Ripon, Yorkshire.

1836 Parker, Langston, Hon. Surgeon to the Queen's Hospital, Birmingham; 20, Colmore row, Birmingham.

1847 Parker, Nicholas, M.D., Paris.

1841 Parkin, John, M.D., Rome.

1851 Part, James, M.D., 89, Camden road, Camden town.

1828 †Partridge, Richard, F.R.S., Professor of Anatomy to the Royal Academy of Arts; Consulting Surgeon to King's College Hospital, and Professor of Anatomy in King's College, London; 17, New street, Spring gardens. S. 1832-6. C. 1837-8, 1861-2. V.P. 1847-8. P. 1863-4.

1865 Pavy, Frederick William, M.D., F.R.S., Assistant-Physician to, and Lecturer on Physiology at, Guy's Hospital; 35, Grosvenor street.

1869 Payne, Joseph Frank, M.B., Lecturer on Pathology at St. Mary's Hospital; Assistant-Physician to the Hospital for Sick Children; 50, Green street, Park lane.

1845 Peacock, Thomas Bevill, M.D., Physician to, and Lecturer on Medicine at, St. Thomas's Hospital; Physician to the City of London Hospital for Diseases of the Chest, Victoria Park; 20, Finsbury circus. S. 1855-6. V.P. 1867. C. 1869. *Trans.* 2.

1864 Pearson, David Ritchie, M.D. 23, Upper Phillimore place, Kensington.

1856 Peirce, Richard King, 16, Norland place, Notting hill.

1830 Pelechin, Charles P., M.D., St. Petersburgh.

Elected

1855 *Pemberton, Oliver, Surgeon to the Birmingham General Hospital, and Professor of Surgery at the Queen's College, Birmingham; 18, Temple row, Birmingham. *Trans.* 1.

1870 Perrin, J. B., Demonstrator of Anatomy at King's College, London; 16, Portugal street, Lincoln's Inn.

1852 Phillips, Richard, 27, Leinster square, Westbourne grove.

1846 Philp, Francis Richard, M.D., Colby House, Kensington.

1867 Pick, Thomas Pickering, Assistant-Surgeon to St. George's Hospital; 7, South Eaton place, Eaton square. *Sci. Com.*

1851 *Pickford, James Hollins, M.D., M.R.I.A., 1, Cavendish place, Brighton.

1841 Pitman, Henry Alfred, M.D., *Vice-President*, Consulting Physician to St. George's Hospital, and to the Royal General Dispensary, St. Pancras; 28, Gordon square. L. 1851-3. C. 1861-2. T. 1863-8. V.P. 1870.

1850 Poland, Alfred, Surgeon to, and Lecturer on Ophthalmic Surgery at, Guy's Hospital; 48, Finsbury Circus. C. 1865-6. *Trans.* 2.

1845 Pollock, George David, *Vice-President*, Surgeon in Ordinary to H.R.H. the Prince of Wales; Surgeon to St. George's Hospital; 36, Grosvenor street. C. 1856-7. L. 1859-62. V.P. 1870. *Trans.* 3.

1865 Pollock, James Edward, M.D., Physician to the Hospital for Consumption, Brompton; 52, Upper Brook street, Grosvenor square.

1843 Pope, Charles, M.D., Glastonbury, Somersetshire.

1846 Potter, Jephson, M.D., F.L.S., Physician to the Liverpool General Hospital for Consumption and Diseases of the Chest; 6, Soho street, Liverpool.

1842 Powell, James, M.D.

1867 Powell, Richard Douglas, M.D., Assistant-Physician to the Hospital for Consumpton, Brompton; 6, Nottingham place, Marylebone road.

Elected

1867 Power, Henry, Ophthalmic Surgeon to, and Lecturer on Ophthalmic Surgery at, St. Bartholomew's Hospital; Examiner in Physiology at the University of London; 45, Seymour street, Portman square. *Sci. Com.*

1851 Power, Robert Francis, M.D., 71, Gloucester place, Portman square.

1857 Priestley, William Overend, M.D., Physician-Accoucheur to H.R.H. the Princess Louis of Hesse; Professor of Midwifery in King's College, London, and Physician for the Diseases of Women and Children to King's College Hospital; Consulting Physician-Accoucheur to the St. Marylebone Infirmary; 17, Hertford street, Mayfair. *Sci. Com.*

1869 Pullar, Alfred, M.D., Physician to the East London Hospital for Children.

1850 Quain, Richard, M.D., Physician to the Hospital for Consumption and Diseases of the Chest; Member of the Senate of the University of London; 67, Harley street, Cavendish square. C. 1866-7. *Trans.* 1. *Sci. Com.*

1835 †Quain, Richard, F.R.S., Surgeon Extraordinary to H.M. the Queen; Emeritus Professor of Clinical Surgery, University College, London, and Consulting Surgeon to the Eye Infirmary attached to the Hospital; 32, Cavendish square. C. 1838-9. L. 1846-8. T. 1851-3. V.P. 1856-7. *Trans.* 1. *Pro.* 2.

1852 Radcliffe, Charles Bland, M.D., Physician to the Westminster Hospital; Physician to the National Hospital for the Paralysed and Epileptic; 25, Cavendish square. C. 1867-8.

1857 Ranke, Henry, M.D., Munich.

1851 Ransom, William Henry, M.D., F.R.S., Physician to the Nottingham General Hospital; the Pavement, Nottingham.

1869 Read, Thomas Laurence, 11, Petersham terrace, Queen's gate, Kensington.

1858 Reed, Frederick George, M.D., 46, Hertford street, Mayfair. *Trans.* 1.

Elected

1821 Reeder, Henry, M.D., Varick, Seneca County, New York, United States.

1857 Rees, George Owen, M.D., F.R.S., Physician to, and Lecturer on Medicine at, Guy's Hospital; 26, Albemarle street, Piccadilly. *Trans.* 1.

1868 Reeve, John Foster, M.D., 40, Brook street, Grosvenor square.

1869 Reeves, William, 5, the Crescent, Carlisle.

1855 Reynolds, John Russell, M.D., F.R.S., Professor of the Principles and Practice of Medicine in University College, London, and Physician to University College Hospital; Examiner in Medicine at the University of London; 38, Grosvenor street. C. 1870.

1865 Rhodes, George Winter, Surgeon to the Huddersfield Infirmary; Queen street South, Huddersfield.

1847 Richards, Samuel, M.D., 36, Bedford square.

1852 Richardson, Christopher Thomas, M.B., Warcop, Penrith.

1849 *Richardson, William, M.D., 25, Gloucester gardens, Bishop's road, Hyde Park.

1869 Rickards, Walter, M.D., Physician to the Royal Free Hospital; 8, Cavendish place, Cavendish square.

1845 Ridge, Benjamin, M.D., 21, Bruton street, Berkeley square.

1843 Ridge, Joseph, M.D., 39, Dorset square. C. 1858. *Pro.* 1.

1863 Ringer, Sydney, M.D., Professor of Materia Medica in University College, London, and Physician to University College Hospital; 15, Cavendish place, Cavendish square.

1852 Roberts, John, M.R.C.P., the Park, Westow Hill, Upper Norwood.

1855 Robertson, Charles Alexander Lockhart, M.D., Visiting Physician in Lunacy to the Court of Chancery.

1857 Robertson, John Charles George, Medical Superintendent of the Cavan District Lunatic Asylum; Monaghan, Ireland.

1862 Robinson, Charles, F.R.C.P. Edinb., 11, Montagu street, Portman square.

Elected

1843 Robinson, George, M.D. *Trans.* 2.

1843 Roden, William, M.D., the Grange, Kidderminster, Worcestershire.

1835 †Roe, George Hamilton, M.D., Consulting Physician to the Hospital for Consumption and Diseases of the Chest; 124, Park street, Grosvenor square. C. 1841-2. *Trans.* 1.

1829 Roots, William Sudlow, F.L.S., Surgeon to the Royal Establishment at Hampton Court; Kingston, Surrey.

1850 Roper, George, Bank house, Aylsham, Norfolk.

1855 Roscow, Thomas Tattersall, M.D., 52, Rue de Commerce, Brussels.

1836 *Rose, Caleb Burrell, F.G.S., 25, King street, Great Yarmouth, Norfolk. *Trans.* 1.

1857 Rose, Henry Cooper, M.D., F.L.S., Surgeon to the Hampstead Dispensary; High street, Hampstead. *Trans.* 1.

1849 Routh, Charles Henry Felix, M.D., Physician to the Samaritan Free Hospital for Women and Children; 52, Montagu square. *Trans.* 1.

1863 Rowe, Thomas Smith, M.D., Surgeon to the Royal Sea-bathing Infirmary; Cecil street, Margate, Kent.

1834 Rumsey, Henry Wyldbore, Priory House, Cheltenham.

1845 Russell, James, M.D., Physician to the Birmingham General Hospital, and Professor of Medicine at Queen's College, Birmingham; 91, New Hall street, Birmingham.

1851 Salter, Henry Hyde, M.D., F.R.S., Physician to, and Lecturer on Medicine at, the Charing Cross Hospital; 14, Harley street, Cavendish square. S. 1866. C. 1868-9. *Sci. Com.*

1856 Salter, Samuel James A., F.R.S., F.L.S., Surgeon-Dentist to, and Lecturer on Dental Surgery at, Guy's Hospital; 17, New Broad street, City. *Trans.* 2.

1849 Sanderson, Hugh James, M.D., Physician to the Hospital for Women, Soho square; 26, Upper Berkeley street, Portman square.

Elected

1855 Sanderson, John Burdon, M.D., F.R.S., Professor of Practical Physiology at University College; 49, Queen Anne street, Cavendish square. C. 1869-70. *Trans.* 1. *Sci. Com.* 2.

1867 Sandford, Folliott James, M.D., Market Drayton, Shropshire.

1847 Sankey, William Henry Octavius, M.D., Lecturer on Mental Diseases at University College, London; Sandywell park, Cheltenham.

1869 Sansom, Arthur Ernest, M.D., Physician to the Royal Hospital for Diseases of the Chest, City road; 29, Duncan terrace, Islington. *Trans.* 1.

1845 Saunders, Edwin, Surgeon-Dentist to H.M. the Queen, and to H.R.H. the Prince of Wales; 13a, George street; Hanover square.

1834 Sauvan, Ludwig V., M.D., Warsaw.

1859 Savory, William Scovell, F.R.S., Surgeon to, and Lecturer on Surgery at, St. Bartholomew's Hospital; 66, Brook street, Grosvenor square. *Trans.* 3. *Sci. Com.* 3.

1853 Schulhof, Maurice, M.D., 46, Brook street, Grosvenor square.

1861 *Scott, William, M.D., Physician to the Huddersfield Infirmary; Waverley House, Huddersfield.

1858 *Scratchley, George, M.D., New Orleans, Louisiana, U.S. [per Arthur Scratchley, Esq., 8a, Waterloo place, Pall Mall.]

1863 Sedgwick, William, Surgeon to the St. Marylebone Provident Dispensary; 12, Park place, Upper Baker street. *Trans.* 1.

1856 Sercombe, Edwin, Surgeon-Dentist to St. Mary's Hospital; 41, Brook street, Grosvenor square. *Trans.* 1. *Pro.* 1.

1840 Sharp, William, M.D., F.R.S., Horton House, Rugby. *Trans.* 1.

Elected

1837 †Sharpey, William, M.D., F.R.S., LL.D., Professor of Anatomy and Physiology in University College, London; Member of the Senate of the University of London; Secretary of the Royal Society; University College, and Lawnbank, Hampstead. C. 1848-9. V.P. 1862.

1836 †Shaw, Alexander, Consulting Surgeon to the Middlesex Hospital; 40, Abbey road west, Kilburn. C. 1842. S. 1843-4. V.P. 1851-2. T. 1858-60. *Trans.* 4.

1848 *Shearman, Edward James, M.D., F.R.S. Edin., F.L.S., Consulting Physician to the Rotherham Dispensary; Moorgate, Rotherham, Yorkshire.

1859 Sibley, Septimus William, 12, New Burlington street. *Trans.* 4. *Sci. Com.*

1849 Sibson, Francis, M.D., F.R.S., Physician to, and Lecturer on Clinical Medicine at, St. Mary's Hospital; Member of the Senate of the University of London; 59, Brook street, Grosvenor square. C. 1863-4. *Trans.* 1. *Sci. Com.*

1848 Sieveking, Edward Henry, M.D., Physician in Ordinary to H.R.H. the Prince of Wales; Physician to St. Mary's Hospital; 17, Manchester square. C. 1859-60. S. 1861-3. *Trans.* 2. *Sci. Com.*

1842 Simon, John, D.C.L., F.R.S., Surgeon to St. Thomas's Hospital; Medical Officer of the Privy Council; 8, Richmond terrace, Whitehall, and 40, Kensington square. C. 1854-5. V.P. 1865. *Trans.* 1.

1865 Sims, J. Marion, M.D., 47, Faubourg St. Honoré, Paris.

1857 Siordet, James Lewis, M.B., Villa Preti, Mentone, Nice.

1824 †Skey, Frederic Carpenter, C.B., F.R.S., Consulting Surgeon to, and Lecturer on Clinical Surgery at, St. Bartholomew's Hospital; 24, Mount street, Grosvenor square. C. 1828. L. 1829-31. V.P. 1841-2. P. 1859-60. *Trans.* 1.

1852 Smith, Charles Case, Consulting Surgeon to the Suffolk General Hospital.

1866 Smith, Heywood, M.A. M.B. Oxon., Assistant-Physician to the Hospital for Women; Physician to the British Lying-in Hospital; 42, Park street, Grosvenor square.

Elected

1835 Smith, John Gregory, Medical Superintendent, Atkinson-Morley Convalescent Hospital, Copse Hill, Wimbledon, Surrey.

1843 Smith, Robert William, M.D., M.R.I.A., Professor of Surgery in the University of Dublin; Surgeon to the Richmond Hospital; Surgeon to Sir Patrick Dun's Hospital; 63, Eccles street, Dublin.

1838 †Smith, Spencer, Surgeon to, and Lecturer on Surgery at, St. Mary's Hospital; 9, Queen Anne street, Cavendish square. C. 1854. S. 1855-8. V.P. 1859-60. T. 1865.

1863 Smith, Thomas, *Secretary;* Assistant-Surgeon to St. Bartholomew's Hospital; Surgeon to the Hospital for Sick Children; 5, Stratford place, Oxford street. S. 1870. *Trans.* 2. *Sci. Com.*

1864 *Smith, Thomas Heckstall, Rowlands, St. Mary Cray, Kent.

1845 Smith, William, 70, Pembroke road, Clifton, Bristol. *Trans.* 1.

1847 Smith, William J., M.D., Consulting Physician to the Weymouth Infirmary; Greenhill, Weymouth, Dorsetshire.

1850 Smith, William Tyler, M.D., Physician-Accoucheur to, and Lecturer on Midwifery at, St. Mary's Hospital; 21, Upper Grosvenor street. C. 1867-8. *Trans.* 2.

1851 Soden, John. *Trans.* 2.

1830 †Solly, Samuel, F.R.S., Senior Surgeon to, and Lecturer on Surgery at, St. Thomas's Hospital; Consulting Surgeon to the Royal General Dispensary, Bartholomew close; 6, Savile row, Burlington gardens. L. 1838-40. C. 1845-6. V.P. 1849-50. P. 1867-8. *Trans.* 6.

1868 Solly, Samuel Edwin, 6, Savile Row, Burlington gardens; and 37, Edward street, Penton place, Newington.

1865 Southam, George, Surgeon to the Manchester Royal Infirmary, and Lecturer on Surgery at the Manchester Royal School of Medicine; 10, Lever street, and Oakfield, Pendleton, Manchester. *Trans.* 4.

Elected

1865 Southey, Reginald, M.D., Physician to, and Lecturer on Forensic Medicine at, St. Bartholomew's Hospital; 32, Montague place, Russell square.

1844 Spackman, Frederick R., M.D., Harpenden, St. Albans.

1834 Spark, James, Italy.

1851 Spitta, Robert John, M.B., Medical Officer to the Clapham General Dispensary; Clapham Common, Surrey. *Trans.* 1.

1843 *Spranger, Stephen, Hursley, Hampshire.

1867 Squarey, Charles Edward, M.B., Assistant-Physician to the Hospital for Women; 13, Upper Wimpole street, *Trans.* 2.

1851 Startin, James, Senior Surgeon to the Hospital for Diseases of the Skin, Blackfriars; 3, Savile row, Burlington gardens.

1854 Stevens, Henry, M.D., Medical Department, Privy Council Office, 8, Richmond terrace, Whitehall.

1842 Stewart, Alexander Patrick, M.D., Consulting Physician to the Middlesex Hospital; 75, Grosvenor street. C. 1856-7. L. 1863-8.

1859 Stewart, William Edward, 12, Weymouth street, Portland place.

1856 Stocker, Alonzo Henry, M.D., Resident Medical Superintendent of Grove Hall Lunatic Asylum, Bow.

1865 Stokes, William, Jun., M.D., Lecturer on Surgery at the Carmichael School of Medicine, and Surgeon to the Richmond Surgical Hospital; 3, Clare street, Merrion square, Dublin. *Trans.* 1.

1843 Storks, Robert Reeve, Paris.

1858 †Streatfeild, John Fremlyn, Surgeon to the Royal London Ophthalmic Hospital, Moorfields, 15, Upper Brook street, Grosvenor square.

1863 Sturges, Octavius, M.D., Assistant-Physician to, and Lecturer on Forensic Medicine at, the Westminster Hospital; 85, Wimpole street, Cavendish square.

1860 Sutro, Sigismund, M.D., Senior Physician to the German Hospital; 37A, Finsbury square.

Elected

1855 Sutton, John Maule, M.D., Brussels.

1861 *Sweeting, George Bacon, King's Lynn, Norfolk.

1854 *Symonds, Frederick, Surgeon to the Radcliffe Infirmary, and Consulting Surgeon to the Oxford Dispensary; 35, Beaumont street, Oxford.

1870 Tait, Robert Lawson, 7, Waterloo street, Birmingham.

1844 Tamplin, Richard William, Surgeon to the Royal Orthopædic Hospital; 33, Old Burlington street.

1848 Tanner, Thomas Hawkes, M.D., F.L.S., 9, Henrietta street, Cavendish square.

1864 Taussig, Gabriel, M.D., 70, Piazza Barberini, Rome.

1852 Taylor, Robert, Surgeon to the Central London Ophthalmic Hospital, and to the Cripples' Home, Marylebone road; 7, Lower Seymour street, Portman square.

1845 Taylor, Thomas, Lecturer on Chemistry at the Middlesex Hospital Medical School; Warwick House, Warwick place, Grove End road, St. John's wood.

1859 Tegart, Edward, 49, Jermyn street, St. James's.

1862 Thompson, Edmund Symes, M.D., Physician to the Hospital for Consumption, Brompton; 3, Upper George street, Portman square.

1857 Thompson, Henry, M.D., Physician to the Middlesex Hospital; 52, Welbeck street, Cavendish square.

1852 Thompson, Sir Henry, Surgeon Extraordinary to H.M. the King of the Belgians; Professor of Clinical Surgery in University College, London, and Surgeon to University College Hospital; 35, Wimpole street, Cavendish square. C. 1869. *Trans.* 4.

1862 Thompson, Reginald Edward, M.D., Assistant-Physician to the Hospital for Consumption, Brompton; 21, South street, Park lane. *Trans.* 1. *Sci. Com.*

1836 Thurnam, John, M.D., Resident Medical Superintendent of the Wilts County Asylum, Devizes, Wiltshire. *Trans.* 4.

1848 Tilt, Edward John, M.D., Consulting Physician to the Farringdon General Dispensary and Lying-in Charity; 60, Grosvenor street.

Elected

1867 Tonge, Morris, M.D., Harrow on the Hill, Middlesex.

1828 Torrie, James, M.D.

1867 Trotter, John William, Assistant-Surgeon, Coldstream Guards; Hospital, Vincent square, Westminster.

1859 Truman, Edwin Thomas, Surgeon-Dentist in Ordinary to Her Majesty's Household; 23, Old Burlington street.

1864 Tufnell, Thomas Jolliffe, Examiner in Surgery to the Royal College of Surgeons of Ireland; 58, Lower Mount street, Merrion square, Dublin.

1862 Tuke, Thomas Harrington, M.D., Manor House, Chiswick, and 37, Albemarle street, Piccadilly.

1855 Tulloch, James Stewart, M.D., 1, Pembridge place, Bayswater.

1864 Turner, George, 9, Sussex gardens, Hyde park.

1845 Turner, Thomas, F.L.S., Consulting Surgeon to the Manchester Royal Infirmary; 77, Mosley street, Manchester.

1806 Vaux, Bowyer, Teignmouth, Devon.

1870 Venning, Edgcombe, Assistant Surgeon, 1st Life Guards; Knightsbridge Barracks, and 24, Belgrave square.

1865 Vernon, Bowater John, Ophthalmic Surgeon to St. Bartholomew's Hospital, and Curator Royal London Ophthalmic Hospital; 44a, Wimpole street, Cavendish square.

1867 Vintras, Achille, M.D., Physician to the French Hospital, Lisle street, Leicester square; 141, Regent street.

1828 Vulpes, Benedetto, M.D., Physician to the Hospital of Aversa, and the Hospital of Incurables, Naples.

1854 Waddington, Edward.

1841 Wade, Robert, Senior Surgeon to the Westminster General Dispensary; 68, Dean street, Soho. *Trans.* 1.

1870 Wadham, William, M.D., Physician to, and Lecturer on Medical Jurisprudence at St. George's Hospital; 12, Park lane, Hyde park.

1864 Waite, Charles Derby, M.B., Senior Physician to the Westminster General Dispensary; 3, Old Burlington Street.

Elected

1868 *Walker, Robert, L.R.C.P. Ed., Surgeon to the Carlisle Dispensary; 25, Lowther street, Carlisle.

1867 *Wallis, George, Benet street, Cambridge.

1861 *Walsh, James, M.D., Staff-Surgeon, R.N., 41, Cathrine street, Limerick, Ireland.

1852 Walshe, Walter Hayle, M.D., Emeritus Professor of the Principles and Practice of Medicine, University College, London; Consulting Physician to the Hospital for Consumption; 37, Queen Anne street, Cavendish square. *Trans.* 1.

1851 Walton, Henry Haynes, Surgeon to St. Mary's Hospital and to the Ophthalmic Department; 1, Brock street, Hanover square. *Trans.* 1. *Pro.* 1.

1852 Wane, Daniel, M.D., 20, Grafton street, Berkeley square.

1821 Ward, William Tilleard.

1858 Wardell, John Richard, M.D., 4, Belmont, Tunbridge Wells.

1846 Ware, James Thomas, Surgeon to the Metropolitan Convalescent Institution; 18, Gordon square, and Tilford house, near Farnham, Surrey.

1818 Ware, John, Clifton Down, near Bristol.

1814 †Ware, Martin, 18, Gordon square. C. 1844-5. T. 1846. V.P. 1853.

1866 Waring, Edward John, M.D. [Agents: Messrs. Grindlay and Co., 55, Parliament street]; 39, Portsdown gardens, Maida hill.

1861 Waters, A. T. Houghton, M.D., Physician to the Liverpool Northern Hospital, and Lecturer on Anatomy and Physiology in the Liverpool Royal Infirmary School of Medicine; 27, Hope street, Liverpool. *Trans.* 3.

1837 †Watson, Sir Thomas, Bart., M.D., D.C.L., F.R.S., Physician in Ordinary to H.M. the Queen; Consulting Physician to King's College Hospital; 16, Henrietta street, Cavendish square. C. 1840-1, 1852. V.P. 1845-6.

Elected

1861 Watson, William Spencer, M.B., Surgeon to the Great Northern Hospital; Surgeon to the Royal South London Ophthalmic and to the Central London Ophthalmic Hospitals; 15, Henrietta street, Cavendish square.

1854 Webb, William, M.D. (travelling).

1840 Webb, William Woodham, M.D., Cliff House, Kirtley, South Lowestoft, Suffolk.

1842 Weber, Frederic, M.D., 44, Green street, Park lane. C. 1857. V.P. 1865.

1857 Weber, Hermann, M.D., Physician to the German Hospital; 10, Grosvenor street, Grosvenor square. *Trans.* 6.

1835 †Webster, John, M.D., F.R.S., Physician to the Scottish Hospital, and Consulting Physician to the St. George's and St. James's Dispensary; 9, Queen street, St. Andrew's. C. 1843-4. V.P. 1855-6. *Trans.* 6. *Pro.* 1.

1844 Wegg, William, M.D., Physician to the St. George's, Hanover square, Dispensary; 26, Park lane. L. 1854-8. C. 1861-2.

1861 Wells, John Soelberg, Professor of Ophthalmology in King's College, London, and Ophthalmic Surgeon to King's College Hospital; Assistant-Surgeon to the Royal London Ophthalmic Hospital; 16, Savile row.

1854 Wells, Thomas Spencer, Surgeon in Ordinary to H.M.'s Household; Surgeon to the Samaritan Free Hospital for Women and Children; 3, Upper Grosvenor street. C. 1870. *Trans.* 7. *Pro.* 1.

1842 †West, Charles, M.D., Physician to the Hospital for Sick Children; 61, Wimpole street, Cavendish square. C. 1855-6. V.P. 1863. *Trans.* 2. *Sci. Com.*

1828 Whatley, John, M.D.

1849 White, John.

1852 Wiblin, John, M.D., Medical Inspector of Emigrants and Recruits; Southampton. *Trans.* 1.

1844 Wildbore, Frederic, 245, Hackney road.

1870 *Wilkin, John F., Roxby House, Folkestone.

1837 Wilks, George Augustus Frederick, M.D. [5, Lincoln's Inn Fields].

Elected

1863 WILKS, SAMUEL, M.D., F.R.S., Physician to, and Lecturer on Medicine at, Guy's Hospital; Examiner in Medicine at the University of London; 77, Grosvenor street, Grosvenor square.

1865 WILLETT, ALFRED, Assistant-Surgeon to St. Bartholomew's Hospital; 36, Wimpole street, Cavendish square.

1864 WILLETT, EDMUND SPARSHALL, M.D., Resident Physician, Wyke House, Isleworth, Middlesex.

1860 WILLIAMS, ARTHUR WYNN, M.D., Physician to the Samaritan Free Hospital; Physician-Accoucheur to the Western General Dispensary; 1, Montagu square.

1840 WILLIAMS, CHARLES JAMES BLASIUS, M.D., F.R.S., Consulting Physician to the Hospital for Consumption, Brompton; 49, Upper Brook street, Grosvenor square. C. 1849-50. V.P. 1860-1. *Sci. Com.*

1859 *WILLIAMS, CHARLES, Assistant-Surgeon to the Norfolk and Norwich Hospital; 9, Prince of Wales road, Norwich.

1866 WILLIAMS, CHARLES THEODORE, M.D., Assistant-Physician to the Hospital for Consumption, Brompton; 78, Park street, Grosvenor square.

1859 WILLIAMS, JOSEPH, M.D. [3, Chichester street, Upper Westbourne terrace.]

1868 WILLIAMS, WILLIAM RHYS, M.D., Lecturer on Mental Diseases at St. Thomas's Hospital; Bethlehem Royal Hospital, Lambeth road.

1829 WILLIS, ROBERT, M.D., Barnes, Surrey. L. 1838-41.

1839 †WILSON, ERASMUS, F.R.S., Professor of Dermatology, Royal College of Surgeons of England; 17, Henrietta street, Cavendish square. *Trans.* 2.

1863 WILSON, ROBERT JAMES, M.R.C.P. Edin., 24, Grand Parade, St. Leonard's-on-Sea, Sussex.

1850 *WISE, ROBERT STANTON, M.D., Consulting Physician to the Southam Eye and Ear Infirmary; Banbury, Oxfordshire.

1825 WISE, THOMAS ALEXANDER, M.D., Rostellan Castle, Rostellan, County Cork.

1841 WOOD, GEORGE LEIGHTON, 27, Queen square, Bath.

Elected

1851 Wood, John, Surgeon to King's College Hospital, and Professor of Surgery in King's College, London; Examiner in Anatomy at the University of London; 68, Wimpole street. C. 1867-8. *Trans.* 3.

1848 Wood, William, M.D., Physician to St. Luke's Hospital for Lunatics; 99, Harley street, Cavendish square. C. 1867-8.

1833 †Wormald, Thomas, Consulting Surgeon to St. Bartholomew's Hospital; 42, Bedford row. C. 1839. V.P. 1854.

1842 Worthington, William Collins, Senior Surgeon to the Lowestoft Infirmary; Lowestoft, Suffolk. *Trans.* 3.

1865 Wotton, Henry, Jun.

1860 Wyatt, John, Surgeon-Major, Coldstream Guards; Hospital, Vincent square, Westminster.

[It is particularly requested that any change of Title, Appointment, or Residence, may be communicated to the Secretaries before the 1st of October in each year, in order that the List may be made as correct as possible.]

HONORARY FELLOWS.

(Limited to Twelve.)

Elected

1853 Brodie, Sir Benjamin Collins, Bart., M.A., F.R.S., Waynflete Professor of Chemistry in the University of Oxford; Cowley House, Oxford.

1847 Chadwick, Edwin, Corresponding Member of the Academy of Moral and Political Sciences of the Imperial Institute of France.

1868 Darwin, Charles, M.A., F.R.S., Corresponding Member of the Academies of Sciences of Berlin, Stockholm, Dresden, &c.; Down, Bromley, Kent.

1857 Farr, William, M.D., D.C.L., F.R.S., General Register Office, Somerset House, and Southlands, Bickley, Kent.

1841 Herschel, Sir John Frederick William, Bart., D.C.L., F.R.S., Foreign Associate of the Academy of Sciences of the Imperial Institute of France; Collingwood, near Hawkhurst, Kent.

1868 Hooker, Joseph Dalton, M.D., D.C.L., LL.D., Director of the Royal Botanic Gardens, Kew; Corresponding Member of the Academy of Sciences of the Imperial Institute of France; Kew.

1868 Huxley, Thomas Henry, LL.D., Professor of Natural History in the Royal School of Mines; Corresponding Member of the Academies of Sciences of St. Petersburgh, Berlin, Dresden, &c.; 26, Abbey place, St. John's Wood.

1868 Lyell, Sir Charles, Bart., D.C.L., LL.D., Corresponding Member of the Academies of Sciences of Paris, Berlin, Philadelphia, Boston, &c.; 73, Harley street, Cavendish square.

Elected

1866 Murchison, Sir Roderick Impey, Bart., K.C.B., D.C.L., LL.D., M.A., F.R.S., Director-General of the Geological Survey; Foreign Associate of the Academy of Sciences of the Imperial Institute of France; 16, Belgrave square.

1847 Owen, Richard, D.C.L., LL.D., F.R.S., Superintendent of the Natural History Departments in the British Museum; Foreign Associate of the Academy of Sciences of the Imperial Institute of France; Sheen Lodge, Mortlake.

1825 Sedgwick, the Rev. Adam, A.M., D.C.L., LL.D., F.R.S., Woodwardian Professor of Geology, Cambridge.

1868 Tyndall, John, LL.D., Professor of Natural Philosophy in the Royal Institution; Corresponding Member of the Academies and Societies of Sciences of Göttingen, Haarlem, Geneva, &c.; Royal Institution, Albemarle street, Piccadilly.

FOREIGN HONORARY FELLOWS.

(Limited to Twenty.)

Elected

1841 Andral, G., M.D., Member of the Institute and of the Imperial Academy of Medicine; Physician in Ordinary to the Emperor of the French; Paris.

1862 Cruveilhier, Jean, M.D., Physician to the "Hôpital de la Charité;" Member of the Imperial Academy of Medicine; Paris.

1864 Donders, Franz Cornelius, M.D., Professor of Physiology and Ophthalmology at the University of Utrecht.

1856 Dubois, Baron Paul, Commander of the Legion of Honour; Member of the Imperial Academy of Medicine; Paris.

1835 Ekströmer, Carl Johan, M.D., C.M., K.P.S., and W., Physician to the King of Sweden; President of the College of Health, and Director-General of Hospitals; Stockholm.

1841 Ehrenberg, Christian Gottfried, Foreign Associate of the Academy of Sciences of the Imperial Institute of France; Berlin.

1868 Gross, Samuel D., M.D., F.R.C.P. Philad., Professor of Surgery in the Jefferson Medical College of Philadelphia.

1866 Hannover, Adolph, M.D., Professor at Copenhagen.

1859 Henle, J., M.D., Professor of Anatomy at Göttingen.

1868 Kölliker, Albert, Professor of Anatomy at Würzburg.

1856 Langenbeck, Bernhard, M.D., Professor of Surgery in the University of Berlin.

1868 Larrey, Hippolyte Baron, Member of the Institute; Inspector of the "Service de Santé Militaire," and Member of the "Conseil de Santé des Armées;" Surgeon-in-Ordinary to the Emperor; Commander of the Legion of Honour, &c.; Rue de Lille, 91, Paris.

Elected

1843 Liebig, Baron Justus von, M.D., Conservator of the Royal Collection, and Professor of Chemistry, in the University of Munich; Foreign Associate of the Academy of Sciences of the Imperial Institute of France; Munich.

1841 Louis, P. C. A., M.D., Honorary Physician to the Hotel-Dieu; Member of the Imperial Academy of Medicine; Paris.

1868 Nélaton, Auguste, Member of the Institute, and of the Imperial Academy of Medicine; Surgeon to the Emperor; Member of the Senate; 1, Avenue d'Antin, Paris.

1862 Pirogoff, Nikolaus, M.D., Professor of Surgery to the Medico-Chirurgical Academy in St. Petersburg, and Director of the Anatomical Institute; Consulting Physician to the Hospitals Obuchow, Peter-Paul, and Maria Magdalena; St. Petersburg.

1850 Rokitansky, Carl, M.D., Curator of the Imperial Pathological Museum, and Professor of the University of Vienna. Referee for Medical and University Education to the Austrian Ministry; Vienna.

1856 Stromeyer, Louis, M.D., Director-General of the Medical Department of the Army of Hanover; Hanover.

1856 Virchow, Rudolph, M.D., Professor of Pathological Anatomy in the University of Berlin; Corresponding Member of the Academy of Sciences of the Imperial Institute of France; Berlin.

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ADVERTISEMENT.

The Council of the Royal Medical and Chirurgical Society deems it proper to state that the Society does not hold itself in any way responsible for the statements, reasonings, or opinions set forth in the various papers which, on grounds of general merit, are thought worthy of being published in its Transactions.

REGULATIONS relative to the publication of the "Proceedings of the Society."

That, as a general rule, the Proceedings will be issued every two months, subject to variations dependent on the extent of matter to be printed.

That a Copy of the Proceedings will be sent, postage free, to every Fellow of the Society resident in the United Kingdom.

That "The Proceedings of the Society" may be obtained by non-members at the Society's House, 53, Berners Street, on pre-payment of an annual subscription of five shillings, which may be transmitted either by post-office order or in postage stamps; —this will include the expense of conveyance by post to any part of the United Kingdom; to other places they will be sent, carriage free, through a bookseller, or by post, the receiver paying the foreign charges.

That a notice of every paper will appear in the Proceedings. Authors will be at liberty, on sending their communications, to intimate to the Secretary whether they wish them to appear in the Proceedings *only*, or in the Proceedings and Transactions; and in all cases they will be expected to furnish an Abstract of the communication.

That Abstracts of the papers read will be furnished to the Journals as heretofore.

ON

AMPUTATION AT THE KNEE-JOINT.

BY

GEORGE POLLOCK, F.R.C.S.,

SURGEON TO ST. GEORGE'S HOSPITAL.

Received Oct. 21st.—Read Dec. 14th, 1869.

Amputation at the knee-joint is, perhaps, one of the very few subjects in practical surgery which has not already been brought to the notice of the Royal Medical and Chirurgical Society. Partly on this account, but especially on account of the importance of this operation, and of its comparatively recent revival, I have been anxious to place on record some few cases which have come under my care, and to relate the circumstances which have induced me to advocate and adopt the operation under certain conditions.

The subject has appeared to me well worthy the consideration of the Fellows of the Society, and I trust the facts herein related will justify this conclusion.

To trace the history of amputation at the knee-joint is not the object of this communication. Though the operation dates back to the 16th century, for a long period of time it was only occasionally advocated, but as frequently discarded. Nor can it be considered to have been more favorably enter-

tained until within the last thirty or forty years, and then not by a large majority of the profession.

I venture to think some share of this apparent indifference, or even dislike to the operation, may be attributed to a positive want of experience, as to its advantages, or as to its results; something, perhaps, may be due to a slight amount of prejudice against cutting through a large joint, and exposing an extensive surface of synovial membrane. For even at this present time amputation through the knee-joint cannot be considered in general favour. "The propriety of disarticulation at the knee-joint," writes Dr. Brinton, of Philadelphia, in 1867, "is still a mooted point in the practice of American Surgery. By a majority of surgeons the operation is, perhaps, regarded with suspicion. Many who in a given case of injury or disease would unhesitatingly amputate through the thigh, would in a similar case shrink from the performance of amputation at the knee-joint."

Since 1830, when Velpeau advocated its adoption, the operation has been slowly advancing in favour, and there has evidently been of late a more general desire to test its merits. It must be borne in mind that there are two different and distinct conditions involved in the proposal to remove the leg at the knee-joint: 1st. If there be disease of the joint with ulceration of the cartilages, amputation should be completed by the removal of the condyles of the femur and the articular surface of the patella, or the whole of that bone. 2nd. If there be no disease of the knee, but, from disease or accident, amputation of the leg be requisite, it should be completed by cutting through the joint without interference with the articular surfaces of the femur or patella.

Mr. Syme was one of the first in this country to encourage surgeons to view this operation as practical and comparatively safe. In 1845, he drew attention to the great mortality attendant on amputation through the thigh, and to the inconveniences of the stump which followed, often irritable, usually uncomfortable, occasionally much retracted and conical, and seldom or never capable of bearing any pressure

on its extremity. Instead, therefore, of cutting through the thigh and the shaft of the femur, he amputated the limb at the joint, and removed subsequently a portion of the condyles. He justly observes that "the warrant for amputation (in diseases of the joint) lies in the bone," and not in the soft parts. By cutting through the condyles, instead of the shaft of the femur, he expected to avoid the risk of necrosis; and by cutting through the cancellated structure of the condyles, he hoped to escape those dangers so commonly attendant on opening the medullary canal. He concluded that amputation through the condyles would ever prove less fatal than amputation through the shaft of the bone, and subsequent experience tends to prove the soundness of his views.

I must here remark that whatever can be urged in favour of amputation through the condyles, may be adduced as equally satisfactory, if not as stronger evidence in behalf of amputation through the joint, without removal of the articular cartilages of femur or patella; and I trust I am justified in advancing this opinion on the strength of certain facts which are presently to be considered.

Mr. Syme, at the time above alluded to, does not appear to have made any reference to—he certainly did not then advocate—the more simple operation to which I refer. Mr. Samuel Lane, of St. Mary's Hospital, was I believe one of the first surgeons in this country to perform this operation. In 1857 he successfully amputated through the knee-joint, without removing the articular cartilage, or the patella; and so satisfied was he with the operation that he has repeated it in several instances, and with very satisfactory results.

Mr. Lane has most kindly favoured me with particulars of all his cases, short details of which are appended in a table annexed to this communication.

Being myself strongly impressed with the conviction that amputation through the knee possessed many advantages not to be attained by the amputation of the limb higher up; and suspecting that the mortality attendant on the one would not exceed that of the other operation, I decided to test its

worth a few years ago. The first opportunity of doing so occurred in 1864, since which time seven other cases have been similarly treated by me. Their chief particulars are contained in the following short notices.

Case 1.—J. F—, æt. 51, admitted into St. George's Hospital November, 1864. He had been suffering for many months with epithelioma of the leg. There was a very large ulcerated surface in the middle of the front of the leg, deep at its centre, and there implicating the tibia; some glands in the groin were slightly enlarged. The patient was much reduced by constant and abundant discharge, most offensive in character. It became a question between amputation through the thigh or at the knee-joint; and as there appeared to be sufficient healthy skin to form a good flap in front, the latter operation was decided on.

The flap, to cover the greater portion of the stump, was made from the fore part of the leg; the posterior flap was cut rather short. The patella was not removed, nor was the articular cartilage of the femur interfered with.

A very slight portion of the margin of the anterior flap sloughed in a few days, but ample tissue was left to make a good cover for the end of the stump. The patient had no bad symptom after the operation, but progressed favorably from the first, and left the hospital in thirty-five days, with an excellent stump, on which he could bear any reasonable amount of pressure.

Case 2.—M. G—, æt. 55, was admitted into the hospital in a very low state of mind and body. She was a lunatic, and was suffering from elephantiasis of the foot and lower half of the leg, upon which were several large and deep ulcers discharging most freely. It was a question whether amputation would save life, though there was no prospect of recovery without it. It was decided that the limb should be removed, and I amputated at the knee-joint in a manner similar to that in the first case. The patella and articular cartilage

of the femur were not interfered with—very little blood was lost in the operation.

The patient appeared unconscious of the loss of her limb. It was impossible to keep her quiet, she knocked the stump about with perfect indifference, and was obliged to be constantly watched to prevent her getting out of bed. In this state she gradually sank and died on the third day after the operation. Her mental condition appeared to influence the result more than the operation, as she refused nourishment, never slept, and was never quiet.

Case 3.—V. B—, was admitted into the hospital with dislocation of the foot outwards on the astragalus. There was very severe contusion of the soft parts surrounding the injury and much extravasation of blood. An attempt was at once made to reduce the dislocation, but as it proved unsuccessful, the achilles tendon and also that of the tibialis anticus muscle were divided, the latter being much stretched. These measures did not prove of any service, and all efforts at reduction failed.

The cause of this failure was afterwards explained by the position of the tendons of the posterior tibial and long flexor muscles, one having slipped in front, the other behind the prominent head of the astragalus. In a few days extensive suppuration took place, and the skin over the astragalus ulcerated. The patient was now removed from the hospital. The condition of the leg became daily worse. Suppuration had extended more than half way to the knee, and the skin as high as the joint was dusky red in colour. A few days subsequent to his removal, while I was dressing the leg assisted by Mr. Lattey, late house surgeon to St. George's Hospital, we observed arterial hæmorrhage from the wound over the astragalus. This so rapidly increased that we were obliged to apply a tourniquet at once; and in the course of the afternoon I amputated the leg. As suppuration had already extended three parts up the leg, I had no alternative but to remove it high up; but as the skin did not offer any encouragement to do so below the knee, I decided

to amputate through the joint rather than above, for I was anxious to avoid cutting through bone, as there already existed signs of incipient pyæmia.

The patient bore the operation well, which was in every respect similar to those already described; the patella was not removed. A small portion of the anterior flap ulcerated, which, considering the condition of the integuments prior to the operation, was not unlooked for. But, though this rendered the healing of the wound somewhat tedious, the patient, when seen some months after, was able to bear any reasonable amount of weight on the extremity of the stump, and used his artificial leg without any inconvenience. During convalescence two very large abscesses formed, one in each thigh; apparently the result of absorption of pus previous to the amputation.

Case 4.—E. L—, æt. 29, was admitted with severe compound fracture of the leg, and extensive laceration of the soft parts. It became a question between amputation through the head of the tibia, the knee-joint, or through the thigh. I decided to operate through the joint, being of opinion that a better stump would be obtained than if the head of the tibia were cut through.

The operation differed in no respect from the previous ones. The patella and articular cartilage were not disturbed.

Phagedæna appeared in the wound a few days after the operation, and secondary hæmorrhage subsequently occurred. Some portion of the anterior flap was lost by sloughing, but ultimately the patient recovered and left the hospital with a good stump. Though the articular cartilage was exposed for many days during the continuance of phagedæna, no subsequent evil results were observed from this circumstance.

Case 5.—W. S—, æt. 48, admitted with compound fracture of the leg, and subsequently attacked by sloughing and phagedæna of the wound. He was so much reduced by repeated attacks of hæmorrhage, that, though very weak and

low, amputation appeared to offer the only prospect of saving life.

The soft tissues of the leg were generally much involved by suppuration and ulceration; still I hoped to be able to secure sufficient flap in front to cover the end of the femur, and therefore decided to remove the limb at the knee-joint. When, however, the leg was separated from the thigh, there was not sufficient skin to cover the condyles without an undue amount of traction on the edges of the flaps. It was, therefore, necessary to remove a portion of the condyles, and the patella was also dissected out. The flaps now readily met, and covered the end of the femur. The patient was not much exhausted by the operation. His subsequent progress was most satisfactory, and he left the hospital hearty and strong with an excellent stump.

Case 6.—J. T—, æt. 39, admitted in 1868, for long-continued chronic ulceration of foot, which had commenced in the toes, and had gradually spread to the foot, destroying all the soft and osseous tissues in its progress towards the ankle. The greater portion of the foot was gone, a pointed ulcerated extremity projected in front of the astragalus and os calcis. This ulcerated surface was excessively painful.

The integument and soft tissues around the ankle and three parts up the leg were thickened, œdematous, and had assumed the characteristic conditions of elephantiasis. The ulceration of the foot was slowly spreading, and threatened sooner or later to involve the structures of the ankle-joint. She was most willing to submit to the loss of the limb. Considering the condition of the soft tissues of the leg, I decided to operate at the knee. The operation was in every respect similar to the first two related, the patella was not removed, nor the cartilage of the femur interfered with.

A very thin line, about an inch and a half in length of the anterior flap, sloughed and readily separated; but beyond this all went well, and the patient recovered with an admirable stump. She was able to bear her whole weight on its extremity.

Case 7.—E. H—, admitted March, 1869, with ulceration of cartilages and partial dislocation backwards of the left tibia of three years' duration. She was a delicate-looking woman, and there was a suspicion of tubercular mischief in the apex of the right lung. Under these circumstances it was not deemed prudent to excise the joint, and consequently amputation was had recourse to through the knee.

The articular surfaces being diseased were removed with a portion of the condyles and the whole of the patella.

A small abscess formed in the part previously occupied by the patella and somewhat retarded recovery; but before the patient returned home in July, the stump had quite healed, was excellent in shape, and capable of bearing the weight of the body.

Case 8.—B. E—, æt. 22, admitted with strumous disease of the knee. The joint was acutely painful and partially dislocated. There was suspicion of incipient tubercular mischief in the apices of both lungs. Under these circumstances it was decided to amputate through the joint rather than excise it. The articular surface of the femur was extensively ulcerated, and was removed with a portion of the condyles; and the patella was dissected out, as its cartilage was similarly affected. Severe hæmorrhage occurred a few hours after the patient returned to bed; the wound had to be exposed, and a large vessel was tied. He was greatly reduced by the loss of blood, and severe constitutional irritation soon followed. The flaps of the stump retracted to a remarkable extent; so much so that a week after the operation the end of the bone was perfectly exposed. By degrees, however, the sawn extremity of the femur became covered with granulations, and the edges of the flaps as cicatrisation advanced, gradually, but very slowly, approached each other. Several large abscesses which formed in the stump had their origin apparently in the cavity occasioned by the removal of the patella.

The patient gradually gained strength; and the stump had nearly healed, some four months after the operation, when

he was removed to our convalescent hospital at Wimbledon. The wound which remained was healthy and cicatrising; nor was there any apparent disease of bone, notwithstanding the long-continued exposure of the end of the femur.

This patient was exceptionally slow in recovering; but when we take into consideration his extremely delicate condition prior to the operation, the subsequent loss of blood, the excessive retraction of flaps, the large abscesses and long-continued profuse discharge, and the subsequent condition of the stump, I think I am justified in considering the case as one affording evidence favorable to amputation through the joint and condyles. I doubt if this patient would have survived under amputation of the thigh higher up, followed by a similar demand on the system.

In the foregoing recital of cases no selection has been made in order to place amputation at the knee-joint in a more favorable light than it deserves. All the cases which have been treated by me are here truthfully recorded.

It will be observed that, of the eight, seven cases recovered and one died. The fatal case was a most unfavorable one for any kind of treatment; her death can hardly be attributed to the operation, nor can it be supposed that her end was hastened by it more than if the thigh had been removed in the usual manner. Cases 3, 4, 5, and 8 were all seriously ill when operated on; and I even venture to think, that similar satisfactory results would not have followed under similar circumstances had amputation through the shaft of the thigh bone been performed instead. And though the cases are far too few to justify any conclusions as to the merits of the operation through the joint, yet when added to the number of cases to which reference is hereafter made, I think it will be conceded that material evidence has been produced to justify an opinion favorable to its adoption.

Before entering into some particulars to which I wish to draw especial attention, it will be satisfactory to state what evidence I have been able to procure as to the advantages or disadvantages of amputation through the knee-joint; and also to state how far its results will bear comparison with

those of amputation through the shaft of the femur. Much of this evidence has been obtained through friends: to the following of whom I am indebted for the kindness and readiness with which they responded to my wishes—viz., to Mr. Willett, Surgical Registrar of St. Bartholomew's Hospital, Mr. Samuel Lane, Mr. James Lane, Mr. Birkett, Mr. Curling, Mr. Cooper Forster, Mr. Henry Smith, of King's College Hospital, Mr. Campbell de Morgan, Mr. Moore, Mr. Sydney Jones, Mr. Durham, Mr. Little, and my colleague Mr. T. Holmes. The mention of these names will prove, if that were requisite, that my evidence is derived from unquestionable sources.

Mr. James Lane, in a letter dated July 1868, states that "the first amputation at the knee-joint at St. Mary's Hospital was in 1857. Since then we have had I should say about a dozen cases, the majority by my uncle (Mr. Samuel Lane), but some by Mr. Coulson, Mr. Ure, and myself. They have all or nearly all been with the long anterior flap, and the patella and the femoral condyles have not been interfered with. I do not at this moment remember any deaths. In all that I have examined afterwards the patella remained distinctly moveable upon the condyles, but drawn up so as to be quite out of the way of the end of the stump."

Mr. Campbell de Morgan says, "I have amputated at the knee-joint three times. One died of pyæmia; one had partial sloughing of the flap, but there was enough left to form a fair covering. The remaining one did well. The one that died had sloughing of the leg from plugged artery after fracture; he was a bad subject and exhausted before the operation. The other two were for disease of the leg. The flap was in each a quadrangular anterior flap, with a short posterior one somewhat in Teale's style. I removed the patella in all my cases; I don't think I should do so again."

Mr. Henry Smith writes to me, "So far as my humble opinion is concerned I regard this operation with such especial favour that I should always adopt it in suitable

cases, in preference to amputation through the lower third of the thigh; for it appears to be almost of necessity a less dangerous, and when the condyles of the femur are preserved the stump must be a better and more useful one."

Mr. Sydney Jones informs me that in the only case operated on in St. Thomas's Hospital (by Mr. Simon), "the flap was made from the front, the ultimate result was very good indeed; but the patient ran much risk from two or more severe attacks of secondary hæmorrhage."

Mr. L. S. Little writes to me, "I have had but one case of amputation at the knee-joint. The operation was done about a year after compound fracture of the leg, by long anterior, nearly rectangular flap, without patella. The result was a useful stump; cicatrix behind."

Mr. Willett has kindly given me the following particulars from St. Bartholomew's Hospital, "There have been several such operations within quite recent years. In every case that it was practicable the flap was raised from the front of the leg."

Mr. Birkett informs me that he has operated in two cases, and in both with large anterior flaps.

Mr. Cooper Forster says, "I herewith send you the report of the only case in which I have amputated at the knee-joint. The man has now a puckered cicatrix, about an inch in diameter, behind and between the condyles of the femur. He bears well on the end of the bone and has a very useful long limb. I am not sure that another time I should not leave the patella."

Mr. Moore writes to me, "I have removed a limb at the knee-joint for a female child, having extensive disease of the tibia. I saw her several years afterwards with a comfortable and useful limb. I took the whole flap from the anterior skin, particularly avoiding the muscle below the head of the tibia, which would have been deprived of its supply of blood from the anterior tibial artery. There was no sloughing, and the stump healed readily. I left the patella. I have since thought so highly of the plan as giving an anterior flap, and, what is of still greater advantage, a flap of skin;

and as followed by rapid healing and an easy stump, that I have since done, or recommended it in about six cases. Of late I have advised the removal of the patella, because I once saw suppuration above it, after it had been left in an excision of the knee; and also because in my first case the patella projected, and seemed as if it must be inconvenient. Nevertheless it was not so. I never saw trouble from opposing cartilage to the inner surface of the flap."

Mr. Durham, of Guy's Hospital, informs me, 1868, that he has operated twice at the knee-joint. In the first case the operation was performed for compound fracture of the leg with severe laceration and crushing of the soft parts. In front the laceration extended nearly to the knee. The anterior flap was carried as low as possible, but not low enough to render its length perfectly satisfactory. The patella was removed; the posterior flap was cut from within outwards, and was made long enough to compensate in great measure for the shortness of the anterior one. The patient left the hospital about two months and a half after the operation with the stump healed but tender. Six months after the cicatrix was firm and sound, but he could bear no pressure on the stump. The integuments were adherent to the bone. Flexion of the limb caused tension of the cicatrix. He could walk well with an ordinary wooden leg. In speaking of the second case, Mr. Durham says, "the only other case in which I amputated at the knee-joint has no claim to be recorded as an instance of the operation in question. I may, however, mention it to you, inasmuch as I think it illustrates the desirability of amputating through the joint, or else some little distance above it. The man had a hopelessly severe smash of the right leg. It seemed to me just possible that there might be enough integument uninjured to allow of amputation through the joint being satisfactorily completed. I accordingly made the attempt, operating very much as in the case of which the notes are enclosed. I found, however, that the flaps would not come nicely together, there was too much tension upon them,

especially when the limb was ever so slightly flexed upon the pelvis. I, therefore, sawed through the condyles of the femur, about an inch and a half above the articular surface, but still through the broad part of the bone, cutting the bone so as to leave a rounded surface. The bone inflamed; suppuration extended up by the side of the bone, as well as in the medullary portion. The flap sloughed and retracted considerably. Subsequently I removed the lower portion of the bone, cutting through the femur about the middle. Ultimately the patient died. This case and the one of which I enclose particulars (already quoted) were the only cases that have come under my care out of a very large number requiring amputation, in which there has seemed the slightest inducement to try amputation through the joint with a fair chance of success. The injury has either been so low as to leave room for amputating below the knee, or has extended so high as to prevent the formation of satisfactory flaps without removing a portion of the femur. I have never seen a case of disease in which the circumstances appeared to me fairly to indicate amputation through the knee-joint. I have no doubt whatever in appropriate cases the operation is an excellent one; and if such cases should occur to me, I should certainly practise it. But I think the appropriate cases must be rare in civil practice. I may perhaps add that the instrument maker we employ unhesitatingly condemns all stumps he has yet seen."

Mr. Holmes informs me that he has operated four times. "Two proved fatal, one of epithelioma of the foot and leg, who died, however, less from the operation than from pre-existing disease, being a man of advanced age and broken constitution; the other a case of injury: a lad about fifteen years of age, who died from pyæmia. The other two recovered. One was a child. The remaining case was a tailor who recovered with an excellent stump, and is, I understand, an active leader in Reform processions, Hyde-park rows, and the like."

Since this letter was written Mr. Holmes has operated on

two other cases, in both of which the condyles were removed; and in one the patella; in the other only the articular surface of the patella. The first died in a few days after the operation from pyæmia. The second recovered with a good stump."

Such are the opinions of men who have had recent experience of this operation. I leave their evidence to speak for itself. The conclusions to me are most satisfactory. The information obtained through these and other sources enables me to place on record the results of forty-eight cases of amputation at the knee, all of which have occurred in England; and all within a comparatively recent period. Some few have been previously noticed, but the greater number, I believe, have never before been published or made use of for purposes of comparison. In either case they are equally valuable for the object in view, as they afford us the opportunity of testing their results with those, already known, of amputation through the thigh.

These forty-eight cases are arranged in the table A appended to this communication; on reference to which it will be seen that of this number thirteen were fatal and thirty-five recovered. A series of forty-five cases, all of which occurred in America and reported by Dr. Brinton,[1] surgeon to St. Joseph's Hospital, Philadelphia, are placed in table B; on reference to which it will be found that of these, thirteen were fatal, and thirty-two recovered.

If the total results of the cases collected in both tables be taken, it will be found that of 93 cases, 26 died and 67 recovered. I think it desirable to mention with respect to these 93 cases, that, although they are all instances of amputation at the knee-joint, in several the articular cartilage, condyles, and patella were removed. My impression is that the removal of articular cartilage, &c., rather augments than diminishes the danger of amputation through the joint. It is only reasonable to suppose that a cut surface of bone, exposed to the action of pus in a wound, would render the patient more liable to evil consequences than if bone and

[1] 'American Journal of Medical Sciences,' April, 1868.

cartilage were left intact. If this be so the fact of these cases being included in the tables should place the success of simple amputation at the knee-joint without removal of cartilage, &c., in a still more favorable light than the results of the whole of these cases would apparently justify.

The total results give a more favorable percentage of recoveries than do the cases referred to by Mr. James Lane.[1] Of 60 cases collected by him; 21 died and 39 recovered. He speaks of this as a high rate of mortality, and accounts for it by saying, "out of these 60 cases, 7 occurred in the Crimea; of which 4 died: hence a rather higher rate of death."

The results of the cases collected in tables A and B contrast favorably with the published statistics of amputation through the thigh; and as a test I have selected those published by Mr. James Lane,[2] for I know not how to arrive at any more just conclusion than to take these as my standard of comparison.

The following are Mr. Lane's figures, viz.:

Amputation through the thigh: Total cases 1346. Fatal 560. Death rate 41·60.

Amputation through the knee-joint: Total cases 60. Fatal 21. Death rate 35·0.

The results of Tables A and B:

Amputation through the knee-joint: Total cases 93. Fatal 26. Death rate 27·97.

If these figures are to be any guide, or if the results of the tabulated cases alone justify any conclusion being arrived at, it must be admitted that the death rate after amputation through the joint is less than that after amputation through the thigh. Mr. Syme, in writing on the comparative safety of the operation, says, "It is upon this ground that I wish to found the operation, and therefore I have said nothing of some other advantages which might be mentioned."

[1] Cooper's 'Surgical Dictionary,' new ed., Article "Amputation."

[2] Ibid.

I should not do justice to our professional brethren in America did I omit to state that much credit is due to them for the steady perseverance with which amputation through the knee has been tested in that country, and for the records they have given us of the results.

Dr. Stephen Smith,[1] in 1852, drew attention to the subject in an interesting paper, in which he mentions that as early as 1824, Dr. Nathan Smith, of New Haven, performed for the first time in America the operation of amputation through the knee-joint, and that the result was successful.

The observations of Dr. Markoe,[2] of New York, published in 1856, are strongly in favour of this operation. He reports the results of eighteen cases.

Still more recently Dr. Brinton,[3] of Philadelphia, in a very able article, has recorded the particulars of several unpublished cases, all of which I have placed, for the sake of comparison, in table B.

Dr. Brinton is favorable to the operation: he says, "in general terms it may be stated that the operation can be resorted to with propriety in many of those cases of injury and disease, which have hitherto demanded amputation through the lower third of the thigh, *provided* the integuments of the knee are sufficiently healthy to furnish materials for flaps; and provided also that the condyles of the femur are not involved to too great an extent."

Dr. Gross,[4] in writing about the operation, says, "Much has been argued in commendation of it, and, if we may judge from the cases which have occurred in the hands of American and European surgeons, it is reasonable to infer that it will soon come into general favour." He approves of the patella being left, as it serves to fill up the gap between the condyles.

The following evidence from the War Department of the

[1] 'New York Journal of Medical Sciences,' Nov., 1852.
[2] 'New York Journal of Medicine,' Jan., 1856.
[3] 'American Journal of Medical Sciences,' April, 1868.
[4] Gross' 'Surgery,' vol. ii, p. 1086.

United States is also satisfactory.[1] "This operation has found numerous advocates during the war, and has been frequently performed. The returns to October, 1864, give 132 cases, of which 52 recovered and 64 died.

"In 6 cases amputation of the thigh was subsequently performed, with 3 recoveries and 3 deaths. In 10 cases the result is undetermined."

"These figures are encouraging, and if we look at the primary operations alone, the result is still more gratifying."

"Of 49 cases of primary amputation at the knee-joint 31 recovered, and 16 died; while two underwent re-amputation; of whom one recovered, and one, a tuberculous subject, died. This gives a percentage of mortality in primary amputations at the knee-joint of 34·9. The mortality of primary amputation at the lower third of the thigh is much larger than this; indeed, it has been already indisputably proved by the Crimean statistics, and by M. Malgaigne, that the mortality in amputation augments in exact proportion as the incisions approach the trunk."

"The objection to amputation at the knee-joint, that the resulting stump is ill-adaped to the use of an artificial limb, is set at rest by the results obtained by Hudson and other manufacturers, who distinctly declare that the stumps from the operations at the knee-joint give a base of support far better than any possibly to be gained in thigh stumps. It is well known that M. Legouest emphatically pronounces the disarticulation at the knee 'une mauvaise opération, plus grave que l'amputation de la cuisse dans la continuité et qui doit être rejetée de la pratique;' basing this assertion on the Crimean returns; but it is probable that the more extended experience of the late war will lead surgeons to share the convictions of Macleod, Baudens, and Malgaigne, that this operation is altogether preferable to amputation at the lower third of the thigh."

Mons. Malgaigne considers amputation at the knee-joint

[1] 'Circular,' No. 6, p. 47, issued by War Department, Washington, Nov., 1865.

to have been too lightly condemned, and that it merits a decided preference over amputation in the continuity of the thigh.

Mons. Baudens[1] says that the opinion of all the principal surgeons of the French Army in the Crimea was, that amputation at the knee should be preferred to that of the thigh in all cases in which it is impossible to amputate through the upper part of the leg.

In 1864 Mr. Carden, of Worcester, published the results of his experience of amputations through the condyles, with a long flap of skin taken from the front of the leg. Long dissatisfied with the faulty stumps produced by the usual method of amputation through the muscles of the thigh, either by the circular or double flap operation, he writes, "I determined to try the method of amputation by a single flap of skin, and I have been so well satisfied with the results, that I have never since that time used any other."[2] In thirty-one cases recorded by him, only five deaths occurred.

I think it will be sufficient, and to me it is satisfactory, to conclude the evidence in favour of this operation by referring to Sir W. Fergusson's observations on the subject. In the last edition of his work[3] he speaks highly of Mr. Syme's proposal to amputate through the condyles of the femur; and adds in reference to the result of one case that "without exception, I deem the stump equal to any I have ever made in the thigh."

In his lectures on the progress of anatomy and surgery, in speaking of the advantages of the operation, he says, "More than twenty years ago I had satisfied myself on that score, and had it not been that I fancied I had struck a richer vein in surgery by the revival of excision of the knee, I am certain that most of those cases which I referred to in my lectures on this operation last season, would have been brought before you now as illustrations of amputation at the knee."[4]

[1] 'Comptes Rendus,' t. xli, p. 1079, 1855.

[2] 'British Medical Journal,' April, 1864, p. 416.

[3] 'Practical Surgery,' 1857, p. 496.

[4] 'Page 270.

It remains to me to make a few remarks on the operation itself, on the advantages of the stump secured by the operation, and on the form of artificial leg adapted to this stump.

In amputating a limb in a case in which the joint is sound, and the disease or injury is confined to the leg, I much prefer a long anterior flap. In this respect I believe most surgeons of experience are now agreed. Mr. Syme at first advocated a long flap to be taken from the back of the leg, but he changed his views, in this respect, after the publication of Mr. Carden's paper, and gave just credit to this eminent surgeon for having practically and successfully demonstrated the advantages of the long anterior flap.

The anterior flap should be sufficiently long and broad to cover the whole of the exposed articular surface of the femur. It should consist entirely of integument taken from the sides and front of the knee and tibia; no muscle should be included in it. Its base should be two thirds of the circumference of the limb; that of the posterior flap should make up the remaining third. In lacerated wounds of the leg, the surgeon must of course make his flap as he best can.

A long anterior flap possesses many advantages over a long posterior one. When adapted to the surface of the condyles, it permits the ready escape of the discharge from the stump, and when the latter is healed, forms a cushion of skin over the end capable of bearing any reasonable amount of weight, for this skin has from childhood been subject to friction and pressure. It contains no large blood-vessels, seldom requires the application of a ligature, and is traversed by no large nerves. It enables the surgeon to cut from behind, muscles, tendons, blood-vessels, and nerves, at right angles with the limb. It ensures the large nerves from being implicated in the cicatrix, as their ends are drawn up behind the condyles and out of harm's way. It favours a cicatrix at the posterior aspect of the stump, one not liable, therefore, to be fretted by the contact of an artificial support.

As the long anterior flap consists of integument alone,

it has a tendency to ulcerate or slough at its extremity soon after the operation. I have observed this occur to a slight extent more than once. Mr. Birkett informed me that he made a long anterior flap in a case in which the limb was very large and fat; whilst the stump was being dressed, about three inches of the end of the flap was observed to change colour, and in a short time was of a dull purplish hue. The following day the upper flap became gangrenous to that extent.

To avoid this chance of ulceration or sloughing it is best to commence the incision for the anterior flap far back on the side of the joint; and after carrying it downwards and across the leg in front, to terminate it equally far back on the opposite side of the joint. I make it a rule to feel for the interval between the edges of the condyle and head of tibia, and to commence my incision at that point, and immediately behind the edge of the hamstring muscle, as it crosses that space. I take especial care never to commence my incision higher than the margin of the condyle. The incision should be carried perpendicularly downwards on the side of the leg till nearly five inches below the lower edge of the patella, then gradually brought across the front of the leg, and when crossing the tibia should be quite five inches below the patella; then carried up the inner side to a point corresponding exactly to that from which the incision commenced. If the knife is introduced higher up than at the point mentioned, the incision will not only be longer than requisite, but the blood-vessels on each side, and which pass from behind forwards, are unnecessarily divided at the base of the flap, and consequently its arterial supply is diminished by so much, and sloughing or ulceration of some portion of its extremity rendered more probable. If the flap be made after the above rule, its base will be as broad as it can conveniently be made, and will consequently be better able to maintain the vitality of its whole surface than if the flap were narrow as well as long.[1]

[1] These directions only apply to cases in which the condyles and patella are

I usually make the posterior flap by cutting from without inwards; it should not be too short, and should consist merely of integument. It cannot be too strongly pointed out that in this operation rather more flap than is absolutely requisite is no evil; the mistake to guard against is not having enough, a mistake apt to occur in the hands of one not familiar with the operation, for it usually happens that directly the deeper tissues behind the joint are divided, the posterior flap is drawn upwards, and sometimes to a considerable and inconvenient extent. As soon as the flaps are completed all the structures round the joint should be divided at a right angle with the limb.

The observations respecting the length of the anterior flap apply especially to the cases in which the condyles are not removed. In these cases the flap must necessarily be longer than when the condyles are sawn through, and the patella removed; in the former there is a tendency to ulceration or sloughing at the extremity of the flap; and hence the necessity of every precaution to guard against such an occurrence.

If there be disease of the knee-joint, the condyles should be partially removed and also the articular surface of the patella, after the leg is separated from the femur; and the long anterior flap in this case may be shorter by an inch or more. If the joint be healthy, it is best not to interfere with either condyles or patella. I have never found any inconvenience result from the patella when left after this operation, and, as already observed by others as well as myself, it serves to fill the depression between the condyles, and adds a roundness to this portion of the stump. I am much impressed with the importance of not interfering with the patella if it is possible to avoid doing so. If its cartilage is diseased, it is best to remove its articular surface alone, but to leave its upper half, or more attached portion, undisturbed. If the entire patella be removed there is left in its place an irregular jagged cavity with a thin layer of skin to form the

not removed. The incision for the anterior flap must extend higher when it is intended to remove the condyles.

cover, while the cut edges of aponeurosis and ligaments form its walls; and when the anterior flap is drawn over the end of the femur and fixed to the posterior one, this cavity becomes the receptacle of fluid, which, in a few days, probably suppurates, and burrows upwards between the layers of muscle and fasciæ; often perforates the skin in front, and requires much time and attention, and often frequent incisions before the parts become sound. Such results in my experience are less liable to occur when the patella is not disturbed or interfered with, or when its articular surface is alone removed. This is best done with a pair of forceps especially constructed for the purpose at my suggestion by Mr. Blaise. The instrument consists of one concave semicircular blunt blade, claw-like, to receive the edge of one half of the patella; the other blade is a semicircular convex-cutting surface: with such an instrument the operator can easily and smoothly shave off as much of the articular face as he may desire. In amputation through a healthy joint I have seen no ill effects from the articular cartilage of femur and patella being left intact. Mr. Erichsen thinks it better to leave the patella in this operation, but to remove the cartilage from it as well as from the condyles.[1] Mr. Butcher advocates the removal of the articular surfaces of the condyles, and is of opinion that the patella should always be removed.[2] But it is not customary to remove the articular cartilage from the glenoid cavity after amputation at the shoulder-joint, or from the acetabulum after amputation at the hip, or from the head of the humerus when requisite to remove the scapula. It is equally unnecessary at the knee-joint. Months after the removal of the leg, and long after the wound has healed, I have found the patella partially moveable when its articular cartilage had not been interfered with. Mr. James Lane has made a similar observation. I have never experienced the least drawback after this operation when the articular cartilages have been left to be dealt with by nature. I have never seen it exfoliate, or retard the healing of the stump.

[1] 'Erichsen's Surgery,' vol. i, p. 53.

[2] 'Essays and Reports,' p. 454.

The more I have compared the stumps secured by amputation at the knee, whether the condyles were removed or not, with those after the amputation through the shaft of the femur, the more satisfied I have been that there is no comparison between the two in strength and facility for locomotion, in subsequent comfort and freedom from pain, and in capability to bear weight and endure exercise.

To adapt a good, useful, and inexpensive artificial leg to such a stump is a matter of no difficulty. A cast of the stump of a recent case under my care, and a fac-simile of the artificial leg adapted to it, have been placed on the table. I have to express my thanks to Mr. Blaise for carrying out my suggestions in the construction of the latter. It fits the stump most perfectly, offers a firm broad bearing surface for its extremity, and, by a very simple contrivance, may be fixed in a straight position when required for walking, or flexed when the patient sits.

In conclusion, I should observe that I do not wish to attach more importance to the operation of amputation through the knee-joint than it really deserves. I hope and believe I have brought forward sufficient evidence to induce surgeons more generally to test its merits, and if hereafter it should prove that a small percentage of life is gained by its more common adoption, the object of this communication will not have been unsuccessful.

TABLE A.—*Cases of amputation at knee-joint.*

No.	Age.	Nature of disease, &c.	Operator.	Result.	Observations.
1	...	Compound fracture	Mr. Little	Recovered	Patella not removed. Anterior flap.
2	...	Primary	Mr. Thomas Smith	Ditto	I am indebted to Mr. Willett for these results. The patella was left in all.
3	...	Secondary	Ditto	Ditto	
4	...	Ditto	Mr. Paget	Ditto	
5	...	Disease	Mr. Thomas Smith	Ditto	
6	...	Ditto	Ditto	Died	
7	43	Tumour of leg	Mr. Birkett	Ditto	Constant vomiting after operation; death on fifth day. Long anterior flap.
8	11	Injury of leg	Ditto	Ditto	Long anterior flap.
9	Man	Ditto	Mr. Cooper Forster	Recovered	Long anterior flap. Patella removed.
10	28	Painful stump	Sir W. Fergusson	Ditto	... I am indebted to Mr. Henry Smith for the results of these cases.
11	11	Disease of leg	Ditto	Ditto	...
12	40	Severe injury	Mr. F. Mason	Died	Died a few hours after operation from collapse.
13	14	...	Sir W. Fergusson	Recovered	Patella removed. ('Lancet,' May 10, 1862.)
14	...	Disease of tibia	Mr. Simon	Ditto	I am indebted to Mr. Sydney Jones for the result of this case.
15	17	Necrosis, &c.	Mr. Hussey, Oxford Hospital.	Ditto	('Med. Gazette,' Dec. 12, 1857.)

16	8	Necrosis	Mr. Sam. Lane	Ditto	Long anterior flap. Patella left.	I am indebted to Mr. James Lane for the results of these cases.
17	18	Medullary cancer	Mr. Coulson	Ditto	Ditto ditto.	
18	50	Epithelioma	Mr. Sam. Lane	Ditto	Ditto ditto.	
19	29	Osteo-sarcoma	Mr. Coulson	Ditto	Long posterior flap.	
20	26	Compound fracture	Mr. James Lane	Ditto	Long anterior flap.	
21	34	Hydatids in tibia	Mr. Spencer Smith	Ditto	Ditto.	
22	28	Compound fracture	Mr. Sam. Lane	Ditto	Ditto.	
23	46	Ditto	Mr. Gascoyen	Died	Long anterior flap. Pyæmia.	
24	31	Ditto of both legs	Mr. A. T. Norton	Ditto	Long posterior flap. Both legs removed at knee-joint.	
25	27	Compound fracture	Mr. Sam. Lane	Recovering 3 months after operation.	Long anterior flap.	
26	...	Ditto	Mr. James Lane	Recovered	Ditto.	
27	...	Sloughing of leg	Mr. De Morgan	Died	Long anterior flap. Pyæmia. Exhausted before operation.	I am indebted to Mr. De Morgan for the results of these cases.
28	...	Disease of leg	Ditto	Recovered	Long anterior flap. Sloughing of flap, but enough left to form fair covering.	
29	...	Ditto	Ditto	Ditto	Long anterior flap. Patella removed in each of Mr. De Morgan's cases.	
30	...	...	Mr. Hulke	Died	Pyæmia.	
31	...	...	Ditto	Ditto	Ditto.	
32	...	...	Ditto	Recovered	Long anterior flap.	

No.	Age.	Nature of disease, &c.	Operator.	Result.	Observations.
33	Child	Disease of tibia	Mr. Moore	Recovered	Long anterior flap. Patella left.
34	32	Compound fracture	Mr. Durham	Ditto	Patella removed.
35	Old man	Epithelioma	Mr. T. Holmes	Died	Long anterior flap.
36	16	Laceration of leg	Mr. T. Holmes	Ditto	Pyæmia. Long anterior flap.
37	Child	...	Ditto	Recovered	Long anterior flap.
38	Man	...	Ditto	Ditto	Ditto.
39	51	Epithelioma	Mr. Pollock	Ditto	Ditto.
40	55	Elephantiasis	Ditto	Died	Ditto. Died three days after operation ; a lunatic.
41	29	Extensive laceration	Ditto	Recovered	Secondary hæmorrhage. Long anterior flap.
42*	48	Compound fracture	Ditto	Ditto	Long anterior flap. Condyles and patella removed.
43	38	Extensive suppuration and hæmorrhage	Ditto	Ditto	Long anterior flap.
44	39	Ulceration, &c.	Ditto	Ditto	Ditto.
45*	40	Diseased knee	Mr. T. Holmes	Died	Long anterior flap. Condyles of femur and patella removed. Pyæmia.
46*	25	Ditto	Ditto	Recovered	Long anterior flap. Articular surface of patella removed and condyles of femur.
47*	32	Ditto	Mr. Pollock	Ditto	Long anterior flap. Condyles and patella removed.
48*	22	Ditto	Ditto	Ditto	Long anterior flap. Condyles and patella removed. Severe secondary hæmorrhage. Retraction of flap. Large abscesses.

TABLE B.—*Cases of amputation at knee-joint.*

1	11	Compound fracture	Dr. Brinton	Recovered	Patella left.
2	10	Ditto	Ditto	Ditto	Long anterior flap.
3	22	Disease of leg, &c.	Ditto	Ditto	Ditto.
4	53	Compound dislocation of foot, &c.	Ditto	Died	Ditto.
5	...	Compound fracture, hæmorrhage	Ditto	Recovered	A small portion of articular cartilage kept up some little irritation, and retarded recovery.
6	36	Gun-shot wound	Ditto	Ditto	Long anterior flap.
7	Man	Ditto	Ditto	Died	Hæmorrhage from wound 3 days after operation proved fatal.
8	30	Disease of Leg	Dr. D. Hayes Agnew	Recovered	Long anterior flap.
9	50	Necrosis, &c.	Ditto	Ditto	Ditto.
10	Man	Lacerated leg	Ditto	Died	Death within 24 hours. Severe internal injuries.
11	27	Ditto, &c.	Ditto	Recovered	Long anterior flap.
12	15	Old injury of leg	Dr. Peace	Ditto	Ditto.
13*	26	Compound fracture	Dr. A. Hewson	Ditto	Articular surface of condyles and patella removed.
14	37	Ditto	Ditto	Ditto	Ditto.
15	23	Ditto	Ditto	Died	Ditto. Pyæmia.
16	22	Enchondroma	Ditto	Recovered	Ditto. Ditto.
17	...	Compound fracture	Ditto	Ditto	Ditto. Ditto.

No.	Age.	Nature of disease, &c.	Operator.	Result.	Observations.
18	14	Sloughing, &c.	Dr. F. F. Maury	Died	Patella left. Spina bifida. Trismus and opisthotonos.
19*	35	Gangrene from exposure to cold.	Ditto	Recovered	Articular surface of condyles shaved off.
20	25	Compound fracture	Drs. Lilly & Coleman	Ditto	Long posterior flap.
21*	12	Caries of tibia, &c.	Dr. T. G. Morton	Ditto	Long anterior flap. Articular surface of condyles removed.
22	30	Compound fracture from gun-shot	Ditto	Ditto	Long anterior flap.
23	46	Necrosis	Ditto	Ditto	...
24	Man	Compound fracture of both legs	Ditto	Died	One leg amputated at knee-joint, the other below.
25*	31	Compound fracture	Ditto	Recovered	Amputation at knee after amputation of leg. Articular surface of condyles removed. Patella left.
26*	37	Ditto	Ditto	Died	Condyles sawn through. Pyæmia.
27	56	Ditto of both legs	Ditto	Recovered	Amputation at knee-joint of one leg two months after accident.
28*	20	Ulcerated stump	Dr. W. Hunt	Ditto	Articular surface of condyles and patella removed.
29*	37	Disease of leg	Dr. Kenderdine	Ditto	Condyles sawn through. Patella saved.
30*	Man	Necrosis	Ditto	Died	Ditto. Patella removed. Pyæmia.
31	Man	Gun-shot wound, &c.	Dr. Edward Shippen	Ditto	Pyæmia.
32*	Man	Old injury from gun-shot	Dr. Erskine Mason	Recovered	Condyles sawn through. Patella left.
33*	Man	Gun-shot wound	...	Ditto	Condyles sawn through.

34	...	...	...	Ditto	This patient suffered from excoriation of the end of stump, and subsequently had limb removed higher up.
35*	21	Gun-shot wound	Surgeon E. Bentley	Ditto	Condyles sawn through. Patella saved.
36*	8	Crushed leg	Dr. Panconst	Died	Condyles sawn through. Patella left. Pyæmia.
37	65	Compound fracture	Dr. Stephen Smith	Recovered	...
38	45	Ditto	Dr. Gross	Ditto	...
39*	55	Traumatic gangrene	Ditto	Ditto	Condyles shaved off. Patella left.
40	18	Gun-shot injury	Dr. John J. Kane	Died	Pyæmia six days after operation.
41	30	Ditto	Dr. Draper	Recovered	Long anterior flap. Patella left.
42	28	Sloughing and hæmorrhage	Ditto	Died	Ditto. Ditto. "Patient died of exhaustion on the 21st day after the operation."
43	22	Gun-shot injury	Ditto	Recovered	...
44	...	Ditto	Assist.-Surgeon C. C. Lee, U.S.A.	Ditto	...
45	35	Ditto	Ditto	Died	Condyles sawn through. Patella left.

Recovered 32. Died 13. Total 45.

Note.—Dr. Brinton has reported these cases more fully in the 'American Journal of Medical Sciences,' April, 1868. He states, "The authority for the histories of these unreported American cases is manuscript information, obtained generally from the surgeon, occasionally from the patient, and personal examination by the writer."

EXPERIMENTS

ON THE

ACTION OF CERTAIN DIURETICS

(CITRATE AND ACETATE OF POTASH, SPIRITUS ÆTHERIS NITROSI, AND OIL OF JUNIPER)

ON

THE URINE IN HEALTH.

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Received November 8th, 1869.—Read February 8th, 1870.

The following paper contains an account of some experiment made on myself, with the object of ascertaining the influence of citrate and acetate of potash, of sp. ætheris nitrosi, and of oil of juniper on the water, urea, and solids of the urine in health.

As clinical evidence is in favour of the diuretic power of these medicines in some diseases attended by anasarca, one of the therapeutical questions to be considered is whether the increased secretion occurs from their action on the portion of renal structure which remains anatomically unchanged, and quite *irrespective* of the altered condition of the blood; or

whether it only takes place in *consequence* of the state of the blood due to the renal or other disease present; in other words, do the medicines chosen for experiment act by themselves on the kidneys, or is that changed condition of the blood and of the whole secreting structure of the kidneys, comprised in the idea of *disease,* necessary in order that diuresis may be produced?

If these substances were found to act as diuretics in health, the former supposition would receive considerable support.

Each set of experiments was conducted under similar conditions of diet and exercise, and lasted about twenty-eight days, on the middle twelve of which the medicine under examination was taken, the medicine-free days before and after this period affording a standard for comparison. Throughout the observations the urine was examined each morning at half-past eight o'clock, from which time the twenty-four hours was reckoned, and the urea and solids determined, the former by Liebig's process, the latter by evaporation and weighing.

Citrate of Potash.

The experiments forming the basis of Tables I and II, were made during the warm summer weather; the former contains the results of the analysis of the urine during twelve days, on which no medicine was taken. On July 6th a rather larger quantity of animal food than usual was consumed, which may probably account, in some measure, for the large amount of the solids. Table II contains the analysis of the urine for twelve days, on which citrate of potash was taken in doses varying from a scruple to a dram at intervals, amounting in the twenty-four hours to from 2 to 4 drams.

On comparing the means of the tables a slight increase in the water in No. II is seen.

The urea and solids are actually diminished whilst taking citrate of potash, the former by 5·4, the latter by 4 grammes,

in the twenty-four hours. This reduction in the solids is very considerable, especially when allowance has been made for the carbonate of potash they contain, as the product of the decomposition of the citrate; it is possibly due to interference with digestion as well as to "an aberration, so to speak, from the normal course of metamorphosis and oxidation, which may impede the formation and elimination of urea."[1]

Whilst taking the citrate, the urine was usually strongly alkaline, except that passed on rising in the morning, and, very frequently, turbid from the presence of phosphates.

Sp. Ætheris Nitrosi (B. P.).

Tables III, IV, and V contain the series of experiments relating to nitrous ether, which was taken in water, in doses varying from 1 to 3 drams, at intervals, amounting in the twenty-four hours to from 10 to 18 drams.

Table IV gives the analysis of the urine on twelve days during which the medicine was taken.

Tables III and V contain the analyses during three and seven days, respectively before and after the period of its injection.

The experiments in table III are too few in number, and hence, in the following comparison, table V is only immediately referred to, although the result obtained is fully confirmed by a comparison of table IV with table I and with the mean of 47 medicine-free days in table XI.

Comparing, then, tables IV and V, nitrous ether would appear slightly to increase the urinary water, by 72 c.c., but to diminish the urea to the extent of 3·4 grammes and the solids to the amount of 8 grammes in the twenty-four hours. Perhaps this decrease in the urea and solids is due to the alcohol contained in the Sp. Ætheris Nitrosi, since

[1] Parkes, 'On Urine,' p. 163.

the experiments of Böcker and Hammond[1] show that the urea is considerably lessened by the ingestion of from 7 to 12 drams of alcohol in the twenty-four hours.

Whilst taking Sp. Ætheris Nitrosi the urine was clear, acid, and free from albumen.

Acetate of Potash.

Tables V, VI, and VII contain the results of the experiments on acetate of potash.

Table VI gives the state of the urine on twelve days on which the acetate was taken, in doses varying from 20 to 40 grains, every few hours, amounting to from 2½ to 3½ drams in the twenty-four hours.

The salt was taken dissolved in water.

The mean excretion of water, whilst the acetate was taken, exceeds that of the seven previous medicine free days, whilst it falls below that of the six succeeding days, the excess amounting to 150 c.c., the diminution to 100 c.c. It should be observed, however, that the weather during the last six medicine free days was decidedly colder than it had hitherto been. Comparing the three tables, the urea and solids are seen to be considerably reduced, the former by from 2 to 4·4 grammes, the latter by from ·7 to 6·7 grammes in the twenty-four hours. The causes of this reduction would probably be the same as in the case of citrate of potash.

These results agree generally with those of Parkes[2] and of Böcker,[3] except that in these experiments the solids were lessened in a far greater degree, even falling below the mean of those on the medicine-free days, notwithstanding the carbonate of potash they contained, and for which allowance must be made. This is, however, only a difference in degree; but W. Moss[4] finds, as the result of his experiments, that

[1] Quoted by Parkes, op. cit., p. 72.

[2] Parkes, op. cit., p. 168.

[3] Quoted by Parkes, op. cit., p. 162.

[4] 'American Journal of Medical Science,' April, 1861.

the water, urea and solids are increased by acetate of potash. Ranke[1] found the water considerably increased in one case.

Whilst taking the acetate, the urine was usually alkaline, and frequently turbid from the presence of phosphates.

Oleum Juniperi.

Tables VIII, IX, and X contain this series of experiments.

Table VIII gives the analysis of the urine during twelve days on which the English oil of juniper was taken. From 5 to 10 drops of the essence were put on sugar and taken every few hours, the total amount in the twenty-four hours being from 30 to 40 minims, a quantity representing from 25 to 33 drams of the spiritus juniperi of the British Pharmacopœia.

On comparing the three tables it is seen that the water, whilst the oil of juniper was taken, was equal to that on the nine previous medicine free days, but fell below that on the ten succeeding days, to the amount of 160 c.c.

The urea was increased by from ·6 to 1·5 grammes, and the solids by from 2 to 4·3 grammes.

Whilst the oil of juniper was taken, the urine was clear, acid, and free from albumen; it acquired a strongly aromatic odour, occasionally faintly recalling the smell of violets. The evaporated residue had also a strong and peculiar odour. No strangury or irritation of the urinary passages was experienced.

Table XI gives the mean results of the previous tables arranged together, and also the mean per twenty-four hours and the mean per one hour of the forty-seven medicine-free days occurring during the experiments. The results are stated in cubic centimeters and ounces, and in grammes and grains.

The following conclusions may be drawn from these observations:—that in health—

[1] Quoted by Parkes, op. cit., p. 162.

1. Citrate and acetate of potash only slightly increase the quantity of water excreted by the kidneys.

2. They distinctly lessen the amount both of urea and of solids excreted.

3. Spiritus ætheris nitrosi slightly increases the amount of urinary water.

4. It decidedly reduces the quantity both of the urea and solids.

5. Oil of Juniper slightly reduces the amount of water excreted.

6. It appreciably increases both the urea and solids.

It would thus appear that, of these four medicines, citrate and acetate of potash and nitrous ether actually *reduce* the urinary solids, whilst they slightly increase the water, and that oil of juniper *increases* the solids whilst it slightly lessens the water.

It is evident that these experiments, performed on one individual, will not establish generally such conclusions, but they at least show that the action of these medicines, with the exception of oil of juniper, as diuretics in *health,* is very uncertain.

TABLE I.—*No Medicine taken.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.
June 28—29.....	1795	36·77	54·80	1·016
„ 29—30.....	1300	33·28	55·54	1·023
„ 30—July 1	1385	34·34	53·84	1·020
July 1—2.....	1305	32·62	54·32	1·022
„ 2—3.....	925	32·19	52·35	1·029
„ 3—4.....	960	31·20	51·45	1·027
„ 4—5.....	1210	32·18	54·07	1·023
„ 5—6.....	1325	33·12	56·57	1·021
„ 6—7.....	1505	39·73	73·79	1·024
„ 7—8.....	1125	34·65	58·49	1·024
„ 8—9.....	955	32·28	54·89	1·029
„ 9—10	1390	34·19	58·17	1·023
Mean per 24 hours	1265	33·88	56·52	1·023
Mean per hour ...	52·7	1·408	2·355	...

Table II.—*Citrate of Potash.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.	Citrate of Potash per 24 hours, grm.	Remarks.
July 11—12	1470	28·22	51·62	1·018	16	Urine alkaline, turbid from phosphates.
„ 12—13	1320	28·24	52·35	1·022	11·5	„
„ 13—14	1260	28·72	53·55	1·021	6	Occasionally acid and turbid.
„ 14—15	1455	31·28	57·91	1·019	9·5	Urine alkaline and turbid.
„ 15—16	1450	32·68	55·80	1·019	10·3	Alkaline or neutral, turbid.
„ 16—17	1140	28·51	49·35	1·020	8	„
„ 17—18	...	...	...	...	5	Urine not collected.
„ 18—19	1140	23·84	51·97	1·020	8·5	Alkaline, sometimes faintly acid.
„ 19—20	1335	26·79	51·25	1·018	10	„
„ 20—21	1620	28·51	54·19	1·019	9·5	„
„ 21—22	1565	30·05	56·35	1·019	10·5	„
„ 22—23	1235	25·14	48·92	1·021	9·5	„
„ 23—24	...	...	...	...	10	Urine not collected.
„ 24—25	...	...	...	...	5·5	
„ 25—26	1020	24·02	46·19	1·023	12	Alkaline, turbid.
Mean per 24 hours.	1334	28·41	52·45	1·020	Total Quantity, 137·6 grm. =2124 grains.	
Mean per hour	55·58	1·183	2·185	...		

TABLE III.—*No Medicine taken.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.
Sept. 8— 9	1430	25·74	47·2	1·017
„ 10—11	1135	31·04	50·75	1·023
„ 12—13	1140	28·51	46 32	1·017
Mean per 24 hours	1335	28·43	48·09	1·019

Nitrous ether taken for 12 days during this interval (see IV).

TABLE IV.—*Nitrous Ether.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.	Nitrous ether per 24 hours. c. c.	Remarks.
Sept. 13—14	1505	26·70	48·25	1·018	21·3	Urine clear, acid.
„ 14—15	1265	29·30	49·52	1·021	37·2	„
„ 15—16	1455	31·24	51·20	1·020	46·1	„
„ 16—17	1520	28·60	50·07	1·018	53·2	„
„ 17—18	1612	30·16	50·72	1·016	49·7	„
„ 18—19	1725	33·46	55·42	1·018	49·7	„
„ 19—20	2040	31·74	52·60	1·013	46·1	„
„ 20—21	1665	28·30	50·20	1·017	42·6	„
„ 21—22	1580	30·50	50·80	1·016	49·7	„
„ 22—23	1590	27·98	48·20	1·015	46·1	„
„ 23—24	1250	26·60	46·60	1·019	42·6	„
„ 24—25	1225	28·50	47·30	1·020	35·5	„
Mean per 24 hours.	1536	29·42	50·07	1·017	Total Quantity, 600 c.c. =18 oz. 2½ drams.	
Mean per hour	64	1·225	2·086	...		

TABLE V.—*No Medicine taken.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.
Sept. 25—26	960	30·24	53·76	1·026
„ 26—27	1660	35·80	62·30	1·018
„ 27—28	1620	33·03	59·60	1·019
„ 28—29	1825	34·85	58·90	1·016
„ 29—30	1790	31·50	54·63	1·016
„ 30—Oct. 1	1085	30·16	57·22	1·027
Oct. 1—2	1310	34·32	59·74	1·022
Mean per 24 hours	1464	32·84	58·02	1 020
Mean per hour ...	61 008	1·368	2·417	...

TABLE VI.—*Acetate of Potash.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.	Acetate of Potash in 24 hours. grm.	Remarks.
Oct. 2—3 ...	1775	36·74	65·94	1·021	13·33	At midday alkaline and turbid.
„ 3—4 ...	1670	34·23	60·17	1·020	13·33	Alkaline and turbid
„ 4—5 ...	1560	29·79	53·65	1·019	8·66	„
„ 5—6 ...	1515	28·50	49·47	1·018	10	„
„ 6—7 ...	1805	30·14	58·13	1·017	11·33	Neutral or alkaline.
„ 7—8 ...	1700	30·17	61·39	1·020	11·33	„
„ 8—9 ...	1590	29·41	56·14	1·019	10·66	„
„ 9—10 ...	1600	29·12	58·04	1·020	11·33	Occasionally acid.
„ 10—11...	1375	29·15	50·29	1 020	10·66	Alkaline.
„ 11—12...	1465	28·42	53·00	1·020	8	„
„ 12—13...	1640	31·65	62·01	1·020	10·66	„
„ 13—14...	1705	31·71	60·37	1·019	11·33	„
Mean per 24 hours.	1616	30·75	57·38	1·019	Total Quantity, 130·66 grm. =1960 grains.	
Mean per hour	67·36	1·281	2·39	...		

TABLE VII.—*No Medicine taken.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.
Oct. 14—15	1630	32·76	57·60	1·018 [1]
„ 15—16	1745	36·64	67·41	1·021
„ 16—17	1640	38·37	68·34	1·020
„ 17—18	1595	34·29	62·66	1·020
„ 18—19	2025	36·65	66·23	1·018
„ 19—20	1655	31·94	61·87	1·020
Mean per 24 hours	1715	35·109	64·018	1·019
Mean per 1 hour	71·45	1·462	2·667	...

[1] The last dose of Acetate of Potash was taken at 7.15 a.m. on October 14th. At 10 a.m. the urine was faintly alkaline and turbid; at 1.15 p.m. it was neutral and turbid—six hours after the last dose; at 5.30 p.m. it was slightly acid—ten hours after the last dose; at 11.30 p.m. it was strongly acid and clear.

Whilst the Acetate of Potash was taken the urine was usually alkaline and turbid from the presence of phosphates. It caused a more frequent desire for micturition than the citrate, as if the urine were more irritating to the bladder, although, weight for weight, more Carbonate of Potash is yielded by Citrate than Acetate of Potash.

TABLE VIII.—*No Medicine taken (before Ol. Juniperi).*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.
Oct. 27—28	1665	31·47	56·32	1·018
„ 31—Nov. 1...	1145	26·9	48·97	1·021
Nov. 1—2	1415	31·13	57·63	1·020
„ 2—3	1275	30·34	58·45	1·023
„ 3—4	1230	30·13	57·78	1·024
„ 4—5	1575	29·76	56·00	1·019
„ 8—9	1210	23·11	46·15	1·020
„ 10—11	1265	28·40	56·23	1·023
„ 11—12	1275	28·30	55·94	1·023
Mean per 24 hours	1339	28·83	54·83	1·021
Mean per 1 hour	55·8	1·20	2·28	...

Table IX.—*Oil of Juniper.*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.	Ol. Juniperi per 24 hours. M.	Remarks.
Nov. 12—13	1030	26·37	50·27	1·025	7	Violaceous odour a short time after first dose.
„ 13—14	1210	30·00	58·70	1·023	30	Urine acid.
„ 14—15	1395	29·15	59 32	1·022	40	„
„ 15—16	1635	28·28	57·95	1·019	47	Odour of urine strongly aromatic
„ 16—17	1315	27·00	60·65	1·025	37	„
„ 17—18	1635	30·90	64·49	1·022	32	„
„ 18—19	1600	34·88	68·53	1·022	30	„
„ 19—20	1280	32·76	63·11	1·025	31	„
„ 20—21	1335	32·84	62·23	1·022	30	„
„ 21—22	1370	27·26	55·38	1·021	31	„
„ 22—23	1195	28·00	57 05	1·026	31	„
„ 23—24	1072	26·05	52·43	1·026	32	„
Mean per 24 hours	1339	29·45	59·17	1·023	Total Quantity, ʒvi, mxviii.	...
Mean per 1 hour.	55·8	1·22	2·46	...	...	...

TABLE X.—*No Medicine taken (after Ol. Juniperi).*

Date.	Water, c. c.	Urea, grm.	Solids, grm.	Sp. gr.	Remarks.
Nov. 24—25	1265	25·00	51·20	1·022	...
„ 25—26	1555	31·41	62·44	1·021	...
„ 26—27	1800	32·94	63·95	1·019	...
„ 27—28	1130	27·00	53·72	1·025	Mean for 4 days: water 1437; urea 29·09; solids 57·83.
Dec. 8—9	1575	28·35	56·98	1·020	...
„ 9—10	1555	27·52	57·25	1·020	...
„ 10—11	1645	30·43	63·08	1·020	...
„ 11—12	1605	26·48	54·69	1·019	...
„ 12—13	1210	24·92	52·62	1·022	...
„ 13—14	1655	25·32	55·22	1·018	Mean for 6 days: water 1541; urea 27·17; solids 56·64.
Mean per 24 hours	1499	27·93	57·11	1·020	...
Mean per 1 hour	62·4	1·151	2·38	...	...

TABLE XI.

	Mean per 24 hours of 12 days previous to Citrate of Potash.	Mean per 24 hours of 12 days on which Citrate of Potash was taken.	Mean per 24 hours of 3 days previous to Sp. Æthers Nitrosi.	Mean per 24 hours of 12 days on which Sp. Æthers Nitrosi was taken.	Mean per 24 hours of 7 days after Sp. Æthers Nitrosi.	Mean per 24 hours of 12 days on which Acetate of Potash was taken.	Mean per 24 hours of 6 days after Acetate of Potash.	Mean per 24 hours of 9 days previous to Oil of Juniper.	Mean per 24 hours of 12 days on which Oil of Juniper was taken.	Mean per 24 hours of 10 days after Oil of Juniper.	Mean per 24 hours of 47 medicine free days.	Mean per 1 hour of 47 medicine free days.
Water, c.c.	1265	1334	1335	1536	1461	1616	1715	1339	1339	1499	1421	59·19
,, ounces...	44·5	47	44·5	54·2	51·6	57	60·5	47·1	47·1	52·9	50·1	2·08
Urea, grammes	33·8	28·11	28·43	29·42	32·84	30·75	35·11	28·83	29·45	27·93	31·30	1·304
,, grains ...	522·8	438·4	438·4	453·4	507·4	474·5	542	444·8	453·4	431	483	20·12
Solids, grammes	56·52	52·45	48·00	50·07	58·02	57·38	64·02	54·83	59·17	57·11	56·96	2·373
,, grains ...	871·2	809·4	741·1	773	895·3	885·5	988	846	913	881·2	878·9	36·6

A CASE

OF

COMPOUND FRACTURE OF THE PATELLA,

WITH AN

ANALYSIS OF SIXTY-NINE CASES OF THAT INJURY.

BY

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Received Nov. 1st, 1869.—Read Jan. 11th, 1870.

Compound fractures of the patella have received but little notice or consideration in surgical works.

Even up to the present period there are but scanty remarks on this lesion, excepting such scattered notes as are attached to cases mentioned in the various periodicals. In fact, these injuries are generally cursorily passed over, and summarily dismissed with the terse phrase "that these are cases in which amputation of the limb is to be resorted to." This latter doctrine we hope to modify, so that it may be applied only to such cases as are attended with extensive crushing of the structures of the joint in association with compound fracture of the patella, and in which resection of the joint is inadvisable.

Our attention was more particularly directed to this class

of injuries in consequence of having had under our care in Guy's Hospital an interesting case of the kind, and which involved the question as to the propriety of primary amputation. Although this case was attended with serious after-consequences, and therefore rather in favour of the doctrine upheld, yet it afforded us a sufficient basis to form a paper on the whole question, and which we have ventured to lay before the Society for their judgment.

It is true that Dr. G. Bouchard,[1] of Paris, has recently published a very excellent brochure on this injury, but he has included together all lesions of the joint-structure, such as fracture of the condyles of the femur and head of the tibia, thus opening a very wide field of inquiry; his collection of cases are arranged according to the different phases of inflammation, suppuration, ulceration, and repair. In the present communication, however, we have confined ourselves entirely to the patella, and arranged the cases in a tabulated form according as the fracture was produced by incised, lacerated, or gunshot wounds; at the same time we have thought fit to append a table of the more serious compound fractures of the joint, in order to show how some of this class of cases may under certain circumstances be recovered from and repaired without the loss of a limb.

The following is a general outline of our case, from notes by Mr. C. S. Chevallier.

George M—, æt. 28, a boiler maker, was admitted into Guy's Hospital on January 19th, 1869. About eight weeks previously he received a transverse lacerated wound over the anterior surface of the right knee, which was produced by a fall on the knee, and for which he was treated as an out-patient at the hospital. The wound was about three and a half inches in extent and the patella was exposed, but the joint was not injured. The edges of the wound were brought together by strapping, and a back splint was placed behind the knee-joint. The case progressed favorably, union of the edges took place, and cicatrization was almost completed, when, about

[1] Bouchard, G., M.D., 'Des Fractures de la Rotule compliquées d'ouverture de l'articulation Tibio-femorale, et de leur Traitment.' Paris, 1868.

three days previous to his present admission, he removed the splint and went about his employment. Early on the morning of the 19th, eight weeks after the first accident, he caught his foot in a grating and was thrown down on his side, in his fall using great muscular exertion to save himself. The newly cicatrized wound was torn open and he suffered great pain. He was immediately brought to the hospital. There was found a large gaping wound at the site of the original injury, as also a transverse fracture of the patella; there was hæmorrhage and escape of synovial fluid from the joint. The dresser on duty introduced his finger into the wound, through the fracture, and into the joint. The wound was closed by sutures, a compress of lint with strapping applied, and a back splint adjusted behind the knee. In this condition he came under the author's notice. The man appeared to be in exceedingly bad health, suffering from a chronic cough and general debility, which gave rise to the suspicion of phthisis, although no evidence could be elicited by the stethoscope.

In the course of three or four days, inflammation and swelling of the joint ensued, with the usual concomitant symptoms. The dressings and sutures were removed and carbolic acid lotion applied to the wound, which was looking unhealthy and had a sanious discharge. On the tenth day suppuration of the joint had fully set in, and the discharge was profuse. This, however, suddenly lessened, when symptoms of pyæmia became manifest, but fortunately suppurative action in and about the joint reappeared, necessitating the use of free incisions into the joint and into such depôts of pus as had formed above and below the joint.

During a lingering and tedious suppuration, with ulcerative action going on in the joint, for a period of six weeks, the man's health began to give way, and on consultation it was agreed that amputation should be performed at the first favorable opportunity, and this was done on the 5th of March. The man made a most rapid recovery and gained flesh, although he did not lose his cough entirely.

The chart of the temperature taken during the progress of

the case presented the usual phenomena of rise and fall during the formation and evacuation of suppurative depôts, and offers nothing of any special interest for recording.

The condition of the knee-joint after removal of the limb presented the following appearances:

There was a ⊢ shaped wound in the integuments over the knee, extending down to the bone, the remains of the original wound and that made by the surgeon; the edges appeared healthy, as if cicatrization was in process of formation. The patella was fractured transversely in its outer two thirds, and then two oblique fractures proceeded from this along the inner third, the one running upwards and inwards, and the other downwards and inwards, giving a triradiate character, ≺, to the whole. The transverse portion had its edges in contact and was covered by thickened tissue, in which nodules of new bone had formed both in the upper and lower fragments, somewhat overlapping and interlocking each other, showing an attempt at bony union. The internal upper radiation had its edges separated, freely laying open the joint; the lower radiation, appearing more like a split, was completely covered by dense and thickened fibrous tissue, derived from the aponeurotic covering, and the edges were so close as to prevent any opening into the joint.

The interior of the joint presented all the usual appearances of the process preparatory to anchylosis.

The cartilage on the posterior surface of the patella and condyles of the femur was mostly removed; the interarticular fibro-cartilage had almost disappeared, and the crucial ligaments were softened and partially absorbed. The osseous surfaces were covered with lymph, and the bone structures rather soft. The integuments, cellular tissue, and muscles above and below the knee, were indurated and infiltrated with a kind of sero-albuminous material.

The preparation is preserved in the museum of Guy's Hospital. No. 1212^{10}.

We will now briefly allude to the special points of interest attached to the case.

And *firstly* the extraordinary and unusual nature of the

accident. The man meets with a lacerated wound in a transverse direction over the middle of the patella, the wound extending to the bone itself, severing the fibrous aponeurosis or protective external periosteum of that bone, and thus so far rendering the patella more amenable to lesion should any subsequent injury occur. At an interval of eight weeks the patient does meet with a second injury to the same joint; he trips up, uses great muscular effort to prevent his falling, and comes to the ground. The newly healed cicatrix is torn open and the patella fractured. The man maintained that he felt the tear and snap of the knee-cap before he fell, but in this he must have been deceived. He may, no doubt, have torn open the cicatrix by muscular exertion, but the peculiar nature of the fracture of the bone, as displayed in the after examination of the joint, tends to show that it was produced by a direct fall, for had the fracture been caused by muscular efforts it would have been of the ordinary transverse variety, and not the transverse ≺ shaped fracture which was present.

On searching the records of surgery only one case bearing any strict analogy to the foregoing could be met with.

It is one described by Pelletan, and is referred to in No. 41 of our table. In this instance there was precisely the same double injury; the wound in the first injury was very small, but attended with a good deal of inflammation, and eventually cicatrized. The second accident occurred at an interval of three months; he fell with his knee doubled under him, the newly cicatrized wound was torn open, and the patella broken transversely across, the separation of the edges being such that one of the condyles of the femur was exposed. Whether this fracture was produced by muscular exertion or by direct violence is an open question, but the probability is the latter.

It may not be out of place to refer to two cases which cannot be called compound fractures of the patella and yet have been classed among them, but which have been excluded from the table, considering that they approach rather the characters of lacerated wounds of the joint. The one is the

oft-quoted case of Sir C. Bell,[1] where a simple fracture of the patella became united by ligament, and where subsequently there occurred an extensive laceration of the integuments and this ligamentous union, laying open the joint. Immediate amputation was performed.

The second case is mentioned by Dr. Croker King,[2] where a gentleman met with a fractured patella which united by ligament with a separation of half an inch. About five months after, he fell with his knee bent under him, causing an immense laceration in front of the joint, tearing through the ligamentous union and opening the joint; inflammation and suppuration followed; secondary amputation was urged, but refused; free incisions were made; he progressed favorably, and cicatrization was complete thirty-three days after the accident.

There is a third case,[3] similar to the above, of a very closely united fractured patella being forcibly torn asunder by a lacerated wound and thus opening the joint. This case, however, has been retained in the tables, as it approaches in every respect the character of a compound fracture, the lower fragment lying distinctly under the lower edge of the wound: the interval between the first and second injuries being seven months. See Case 28.

The second point requiring a few passing comments is the treatment adopted in the present case. When first seen by me there was considerable doubt as to the line of treatment that should be carried out. Here was a man in bad health, with a chronic cough and depressed in mind from domestic troubles (not alluded to in the report), suffering from a compound fracture of the patella. Were we justified in attempting to save the limb, or should excision of the joint or amputation have been performed? The subsequent course of the case fully confirms the view taken of a possibility of a repair. The man passed through all the primary dangers of inflammation and suppuration of a large joint, having had occasional relapses and threatening symptoms of pyæmia, and yet repair was going on slowly, by the preparatory

[1] 'System of Operative Surgery,' by Sir C. Bell, vol. ii, p. 204, pl. v.

[2] 'Dublin Medical Press,' Dec. 8, 1847, p. 353.

[3] Seutin's case, see No. 28 in the Table.

process of removal of the articular cartilage by ulceration previous to anchylosis; but, unfortunately, the man's powers began to fail and were not adequate to undertake the completion. His health rapidly gave way suppuration extended above and below the joint, and he was being drained by an exhausting and copious discharge of pus. Under these circumstances no alternative was left but to excise the joint or perform amputation. We preferred the latter, as we considered that the patient had not power enough to undergo the whole process of repair after excision.

The following tables of cases of compound fracture of the patella are now added, and every one has been referred to its original report for accuracy and confirmation.

We have been compelled to omit from these tables three cases of compound fracture of the patella extending into the joint, and brought to a successful termination, which have been mentioned by Hamilton in his third edition of his work on 'Fractures and Dislocations.' The cases are stated by him to be reported by Mr. Post, of New York, in the 'New York Journal of Medicine,' Series I, vol. ii, p. 367; but on referring to this work there is no account whatever, and hence we have been unable to ascertain the precise nature of the lesion, whether simple or complicated, the character of the wound, or whether the cases are already included in the tables.

TABLE I.—*Compound fracture of the*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
1	Sailor.	Good.	Fell from mast on deck, striking knee against edge of a ship's cutlass.	Clean transverse wound across knee, dividing the patella transversely, the joint remaining unopened.
2	M., young.	—	Sabre wound.	Wound at external and anterior part of the patella, dividing it throughout so as to expose articular surfaces of joint. It passed obliquely from without inwards, and from above to below.
3	M., grenadier à cheval.	—	Side arm.	Right patella divided through whole of its thickness and condyles of femur involved. Considerable hæmorrhage.
4	M., æt. 6.	Delicate.	Slipt on climbing into bed, and fell out on chamber utensil, fracturing latter, and injuring knee.	Incised wound of the joint 1 to 1½ inches long, dividing cleanly the tendon of the triceps, and a portion of the upper border of the patella; crucial ligaments exposed, and articular surfaces of bones and semilunar cartilages.
5	M., middle-aged, joiner.	—	Hatchet.	Left patella divided into two equal parts in its long axis, and joint entirely exposed.
6	M., æt. 11.	Good constitution.	Blow from axe whilst sitting astride log of wood with knee bent.	Complete splitting of lower extremity of patella into an anterior and posterior portion, and then almost severing articular surface of internal condyle of femur, forming a large open wound.
7	M., æt. 15.	—	Straw-cutting machine.	Clean straight wound about 2½ inches long penetrating into joint, dividing partially the quadriceps tendon, and completely the patella in an oblique direction downwards and outwards, so that the upper and outer third of patella lay wholly everted in the gaping wound.
8	Boy, æt. 8.	Healthy.	Blow of an axe.	Patella cut through transversely into two nearly equal portions, so that joint laid open and could be seen into.

patella associated with incised wounds.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Limb extended and placed at right angles to trunk.	Parts healed kindly; no constitutional symptoms; bony union ensued, and a perfect recovery resulted.	R	Travers; Obs. Surgery, 1852, p. 17.
Brought into close apposition.	Swelling of thigh and leg, fever, intense pain in knee, suppuration; swelling extended up to the body; joint became disorganized and full of pus.	D	Recorded by Boyer, 1802; t. iv, p. 30; Bruneau; Thèse de Paris, 1802; Plaies des Artic.
Compression ineffectual; amputation not performed.	Extravasation of blood into joint and surrounding parts; suppuration; complete disorganization of soft parts, femur denuded, and cartilages destroyed.	D	Larrey; Mém. de Chir. Milit., t. ii, p. 475.
Back splint; edges united by sutures as near to patella and triceps as possible. Collodion over wound. No antiphlogistic treatment.	Splint became disarranged, and part of wound gaped, with escape of synovia; readjusted; swelling and redness for several days, and escape of pus, mixed with synovia; granulation. Splint worn for two months; at end of four months perfect recovery, and motion of joint perfect.	R	Orton; Med. Times and Gazette, April 20, 1867, p. 412.
Interrupted suture.	Eight days after, swelling, and tension of thigh, leg, and foot, threatening gangrene; free incisions, and removal of outer portion of patella to give freer vent. Recovery, with straight anchylosis.	R	Gelée, 1785; Journ. de Méd. Milit., t. iv, p. 503; Boyer, t. iv, p. 427.
Protruding portion of internal condyle removed; edges brought together by four interrupted sutures; back splint; ice uninterruptedly for eight days.	Fever and inflammation; controlled; cicatrization completed on seventeenth day. In three weeks fractured patella seemed to have united. Perfect union and ultimate recovery, with entire use of limb.	R	Johnstone, of Montreal; Med. Gazette, vol. 37, n. s. vol. 2, p. 348, quoted by Solly in his "Experiences."
Edges drawn together; parts fully and softly padded; straight splint with dry dressing.	In four days almost complete union of edges. In two weeks patella felt firm. Walked, with aid of crutch and stick, in five weeks; soon able to do without either.	R	Rodgers, of Galston, Ayrshire, June, 1865, communicated by A. D.
—	Fragments of bone united without any apparent affection of the synovial membrane.	R	Dr. Bond; Philadelphia Journal Med. and Phys. Sciences, vol. ii, p. 273.

TABLE II.—*Compound fracture of the patella*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
9	M.	—	—	Compound fractured patella, transversely through the centre.
10	M.	—	—	Small penetrating wound with fractured patella.
11	M., workman, just arrived in London from country.	—	Fell out of warehouse into street.	Compound fractured patella.
12	M., æt. 39, gentleman.	Good constitution, not irritable.	Thrown from gig and struck knee against wheel.	Fractured patella and joint laid open, permitting the introduction of the finger. Patella in fragments. Abundant hæmorrhage and escape of synovia.
13	M., æt. 40, labourer.	Healthy, intemperate.	Fell with leg under him across some pig-iron.	Laceration over knee; patella fractured and comminuted; synovia escaped.
14	F., æt. 19, servant.	Pulmonary catarrh. Feeble.	Fell from 2nd floor on to a grating, which gave way, falling through on to pavement.	Wound of knee and vertical fracture of the patella into two unequal pieces. Very severe acute pain. Much contusion and extravasation of blood in soft parts.
15	M., æt. 33 courier.	Bilious and exsanguineous temperament.	Thrown from vehicle against a pillar.	Comminuted compound fracture of left knee; double fracture of lower jaw. There was a large wound in the knee of the form of Y.
16	M., Brigadier of Cuirasiers.	—	Kick from horse.	Lacerated wound of right knee to extent of one inch, with fractured patella in three pieces.

sociated with lacerated and contused wounds.

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	Violent inflammation; intense consecutive fever; suppuration; tension; extension up thigh. No opportunity for secondary amputation. Preparation in Museum of St. Thomas's Hospital, Section A, No. 125.	D	Cooper, William, 1797; Guy's Hospital; Sir A. Cooper on Disloc. and Fract., edited by B. B. Cooper, p. 234.
Fomentations and cata-asms.	Inflammation and suppuration; intense symptoms.	D in few days	Birch; St. Thomas's Hospital; Sir A. Cooper; case 135, op. cit.
—	Suppuration excessive; amputation advised and refused. Sent into country; recovered, with anchylosed joint.	R	Hawker; Sir A. Cooper; case 136, op. cit.
One small piece of bone ose and removed. Su- ure in integuments, strap- ng, back splint. Con- ant application of spirit tion.	Slight febrile symptoms; passed off; no accident. Left bed at end of a month; recovered entire use of limb; union of patella. Lived until 1869, with good use of knee.	R	Dixon, 1819; Sir A. Cooper; op. cit. case 137.
Back splint; large quan- ty of leeches freely and -sparingly used. Pad er wound and bandage.	Great pain, renewal of leeches, subsidence; no subsequent bad symptom. Perfectly cured and useful limb; left hospital in six weeks; union of patella.	R	B. B. Cooper; Sir A. Cooper's work, op. cit., case 139.
Wound brought to- ther and dry dressing.	Abundant suppuration; wound did not heal; febrile symptoms, no sleep, frequent cough. Succumbed to internal affections.	D	Dupuytren; Leçons Orales, t. i, p. 446, edit. 1839.
Two fragments extract- l, edges brought toge- ier, and starch bandage; nesection; emetics and w diet.	Was able to walk at end of eight days; osseous union of fracture of patella and jaws in five weeks; consolidation of fracture.	R	M. Leimange, of Berne; communicated by M. Sentin; Gaz. Méd. de Paris, Sept. 10, 1853, p. 576.
Venesection, cold, back lint.	Doing well for four days, and on fifth violent inflammation, swelling, &c. Suppurating joint. Amputation on twenty-fourth day. Fever, hectic, abscess, threatening death. Rallied, and recovered in sixty-seven days.	R	Fournier; Thèse de Paris, 1823; Bouchard, Memoirs, 1868. p. 18, case 2.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
17	M., æt. 51, physician.	Good constitution, quiet.	Horse struck both knees, causing contusion to right and wound of left.	Transverse fracture of left patella at junction of upper with middle third; the iron shoe had cut open the joint by a transverse wound to the extent of five centimetres. When the knee was straightened, the wound of the integuments and the fracture were not parallel.
18	M., æt. 45.	—	Block of stone forced by explosion against right knee.	A long open wound with vertical fracture of the patella, and exposure of the condyles of the femur.
19	M., æt. 48.	Strong and vigorous.	Direct fall on rocky ground.	Transverse wound on anterior surface of knee to extent of 8 millimetres, and transverse fracture of patella. Quantity of blood and synovia escaped.
20	M., Captain Reg. of Dragoons.	—	Whilst galloping struck right knee against wheel of coach, and thrown down with horse.	An irregular contused wound capable of admitting three fingers into the joint; the patella fractured into fragments; abundant hæmorrhage, and free flow of synovia; tumefaction slight.
21	M., æt. 20, worker in clay pits.	—	Fell 40 feet into a pit on to a cask.	Transverse wound at anterior part of knee 12 centimetres long, largely gaping and corresponding to transverse fracture of the patella; edges separated 2 centimetres; collapse, and laid in pit all night; brought to hospital on following day; no swelling, no hæmorrhage; fractured arm.
22	M., æt. 36, workman.	Strong, sanguineous.	Thrown from a rock by explosion, and fell 5 metres on ground.	Patella comminuted and joint laid open; had also fracture of lower part of leg and dislocated clavicle. Wound 22 centimetres transversely and 10 centimetres vertically, in shape of a cross, with loss of substance, at the junction of the two branches of the cross.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Edges of wound brought together by sutures, and collodion applied over; limb placed on a raised inclined plane and fixed; application of ice; low diet.	Went on well until fourth day, when fever, suppuration occurred, and decomposing gas escaped. Acute arthritis; extensive phlegmonous inflammation; free incisions. No chance of amputation.	D	Verneuil; Gaz. des Hop., Sept. 2, 1865.
Immobilisation and irrigation for twenty-five days.	Suppuration and phlegmonous inflammation in popliteal space laid open; cicatrisation in five months; solid anchylosis, with knee slightly bent.	R	Bleynie, père; Rev. Méd. de Limoges, Sept. 15, 1867; Bouchard, p. 36, case 15.
Back splint and limb raised, wound brought together, collodion daily over wound, and ice permanently used for two weeks.	Enormous effusion of blood and serosity in joint; inflammation set in and subsided; no local or general disturbance; fibrous callus united the two fragments, and left hospital in fifty days. Some months after had a fall and ruptured the fibrous callus. Treated by immobilisation and again good union. Walks as well as ever.	R	Verneuil; communicated to M. Bouchard, case 16, p. 53.
Fragments placed in position, and edges of wound brought together by strapping, compress, and bandage. Back splint, and leg raised. Evaporating lotions.	Great constitutional disturbance; venesection, purgatives, cold lotion; wound healed by first intention, except a small point in centre. Able to walk at end of three months.	R	Lawrence, 1834; Letter to Sir A. Cooper; Guy's Hosp. Rep. Ser. I, vol. i, p. 241.
Fingers introduced into wound to ascertain condition of condyles and tibia, but both intact; limb extended; continuous irrigation; no attempts to re-unite wound.	Inflammation, swelling, and suppuration, depôts formed; long incisions perpendicular to the transverse wound, and laying open joint freely; irrigation continued; granulation; gradual recovery, with partial motion and fistulous opening; latter closed by operation. In hospital for five months.	R	Duplay, Sept. 1867; Bouchard, case 21, p. 67.
Wound cleansed, continuous current of cold water; amputation refused. Extraction of all the fragments of the patella one by one, and joint thus completely laid open. Cartilage of femur in two places detached. Six sutures in the wound.	Suppuration on fourth day; granulation on the tenth. Depôts above and below knee laid open, and drainage tubes inserted. Rapid cicatrization, and completed in three months without anchylosis.	R	Emery, 1861; Bouchard, case 23, p. 73.

No.	Sex, Age. Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
23	M., æt. 23, Zouave soldier.	Robust.	Whilst drunk fell from height of 18 metres on to a rock.	Small contused wound, size of 20-centimes piece; joint distended with fluid. Transverse fracture of the patella, the upper piece entire, the lower divided into several unequal fragments held together by the periosteum.
24	M., æt. 23, Dragoon 11th regiment.	Good constitution.	Kick from horse.	Integuments torn to the extent of 2 inches; right patella fractured obliquely from above to below and within outwards; joint laid open and exposed to view. Synovia escaped.
25	F., æt. 38, domestic in country.	—	Thrown from cart.	Laceration over knee, and comminution of the patella into five unequal pieces; great pain and much swelling.
26	—	—	—	Patella broken into pieces, and the opening so large as to admit fingers into joint readily.
27	—	—	—	Bad compound fracture of patella comminuted.
28	M., æt. 26.	Strong.	Fell on corner of pavement.	Transverse wound at anterior and middle part of left knee, transverse solution of continuity of patella, and much separation. Seven months before he had fractured the same patella by fall on pavement, and treated in hospital for three or four months. Soon after, was frightened by a dog and stretched the knee, followed by inflammation and swelling, and was in hospital again for five weeks. Had only left hospital four weeks.
29	M., æt. 35. stage driver.	—	Kicked by a horse.	Compound comminuted fracture of left patella, attended with profuse hæmorrhage.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Back splint and leg raised. Leeches.	Febrile symptoms, inflammation, swelling, and tension; soon subsided. Went on well till seventh day, when large quantity of blood came away from knee; suppuration; laying open joint; drainage tubes; extraction of detached fragments; recovery, with limited motion, but not complete anchylosis.	R	Baizeau, 1862; Bouchard, case 24, p. 76.
Splint behind knee; white of egg bandage.	Patient moved about so that it had to be re-applied on fourth day; external wound cicatrised. Imprudently walked upon crutches on twentieth day; however, cure resulted in forty days, with anchylosis.	R	Recueil de Mém. de Méd. et de Chir. Mil., vol. xxvi, p. 207, 1829.
Removal of the whole of the fragments of patella.	In four weeks able to walk, and at end of several months able to follow ordinary occupation.	R	Congdon, 1843; Lancet, April, 1843, p. 112.
—	Tedious confinement, and formation of abscesses; separation of fragments of bone. Recovery, with stiff joint.	R	Vincent; St. Barth. Hosp., 1820; Observ. Surg. Practice, p. 72, 1847.
Fragments of bone not removed.	Much suppuration, and danger of losing life and limb. Recovered with anchylosis.	R	Vincent; Cooper's Dict., vol. i, p. 755.
Interrupted sutures, strapping compresses, and bandage. Straight splint and leg raised; venesection, emetics, ice.	Pain and swelling; phlegmonous inflammation; suppuration; incision. Had pleuro-pneumonia, fistulous openings—repeated hæmorrhages from these—exhaustion; at end of four months amputation of thigh.	R	Seutin, 1844; Jour. de Chir. de Malgaigne, t. iv, p. 120, April, 1846; Journ. de Méd. de Bruxelles.
Splint, and kept in bed.	No bad symptom, and doing well. At end of four weeks got up and walked with crutches; inflammation and swelling of joint followed; then suppuration, requiring free incision on either side into joint; protracted discharge. Secondary amputation advised and refused. Ultimately recovered, with a partially anchylosed joint. Able to resume his former employment.	R	Levergood, 1859; Amer. Journ. of Med. Sciences, 1860, vol. xxxix, p. 85.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
30	M., admitted into Pennsylvanian Hospital, March 25, 1835.	—	Piece of rock thrown by explosion against knee.	Compound fractured patella.
31	M., æt. 20, soldier, 39th line.	—	Bursting of shell.	Contused wound and lesion of patella.
32	M., æt. 28, soldier, 18th line.	—	Bursting of bomb.	Lacerated wound and fracture of patella.
33	M., æt. 28, major B.	Strong, healthy.	Piece of shell.	Laceration of right knee to extent of 4 inches. Patella fractured in five pieces, joint laid open, and anterior part of condyle of femur grazed. The pieces were remaining attached to the capsular ligament, tendon of rectus, and ligamentum patellæ.
34	M., æt. 35, bricklayer.	—	Fell from scaffold and pitched on left knee.	Patella broken into three or four pieces; joint laid open so as to admit fingers, and was filled with blood.
35	M., æt. 29, engineer.	—	Fell with his horse.	Compound fractured patella, and lacerated wound into the joint. The surgeon passed the finger freely into the joint. Patella broken into several fragments.
36	F., æt. 34, servant.	—	In a fit of insanity threw herself out of lofty window.	Compound fracture of left patella opening into the joint; also large lacerated wound over the frontal bone.
37	James D., æt. 26, porter at hotel.	Healthy looking, lived freely.	Stepped on to a glass skylight, and fell through on to a stone floor, 20 feet, alighting on his feet, and fell forwards on his knees.	Compound fracture of the left patella into three or four pieces, the lines of fracture appearing to run from the centre outwards. Lacerated wound over centre of patella, not very extensive. Had also dislocation of right astragalus forwards and outwards.

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	June 6th, six weeks after injury, very slight union of fracture.	—	Kirkbridge, 1835, Amer. Journ. Med. Sci., Aug., 1835, p. 330.
—	Permanent flexion of leg on thigh; anchylosis; incomplete atrophy of limb.	R	Chenu; Statistics of Crimea; Bouchard, p. 37.
—	Complete anchylosis, with fistulous opening at external part of patella.	R	Ditto, ditto.
Back splint and uniform compression.	Traumatic fever moderate, as also the pain and swelling; suppuration in thigh; free incision. Bark, wine, and support. Two pieces of patella came away: the three others remained fixed. Complete anchylosis.	R	Hennen's Military Surgery, 2nd edit., p. 153.
Amputation urged, but refused. Wound drawn together, and covered with white of egg.	On fourth day pain and inflammation; eighty leeches; wound became unhealthy, disposition to gangrene; hectic, fetid, sanious discharge. Lived five weeks.	D 5 wks.	Smyly, 1859; Dublin Quart. Journ. of Med., vol. xxvii, p. 361.
Wound closed by the many-tailed bandage; back splint, and foot raised.	On third day wound unhealthy, and dark fœtid matter. Limb greatly swollen, acute pain, fever. On fifth day wound enlarged by incision 2 inches long; abscesses formed and opened. On eleventh day abscess over parotid opened and amputation performed. Death five days after operation, and sixteen days after the accident.	D 16 days	Ditto, ditto.
In such a state of mental excitement that amputation could not be performed.	On fifth day whole limb œdematous, skin red, putrid matter from wound, highly irritative fever, dilatation of wound, abscesses, long incisions at inner side of thigh, knee, and upper part of leg. Wine and opium. On twenty-fifth day was sufficiently rallied; amputation performed; recovery; had no signs of insanity.	R	Ditto, ditto.
Under chloroform the dislocation was easily reduced. Left limb extended on a back splint; wound covered with a pad of lint.	All remained quiet for ten days, when joint became hot and swollen, and febrile symptoms. The wound began to suppurate and discharge freely, but parts around knee remained tense and swollen; abscesses; free incisions. Ligaments about knee became so softened as to require the most support to prevent displacement. Later a bandage stiffened with starch, was applied. Recovery in four months, with anchylosis.	R	Savory, 1869; St. Barth. Hosp.; private communication, unpublished.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
38	M., æt. 35, carpenter.	Good constitution.	Falling of a heavy iron chain on knee.	A widely gaping wound about 3 inches long, with transverse fracture of the patella, fully exposing the joint.
39	F., æt. 63.	Some years before had inflammation of joint, deep-seated abscesses, and partial anchylosis resulting.	On going upstairs fell down two steps leg doubling under her, knee striking one of the steps.	Transverse fracture of patella, with wound laying open cavity of joint, extending round the knee on either side as far as the popliteal space. Part of fractured patella protruded through the wound; considerable hæmorrhage.
40	M., æt. 37, warehouseman.	Good, has had syphilitic rheumatism.	Fell 8 feet on to pavement, from warehouse, striking knee and wrist.	Transverse wound over ligamentum patellæ; transverse fracture of patella; wound unquestionably communicating with joint. Fractured lower end of radius.
41	M., æt. 26.	Sanguineous, robust.	Fell whilst walking, and struck right knee.	Large open wound, patella ruptured across, and internal condyle of femur exposed to view. Got up and walked for ten minutes. About three months before fell from horse; had a small wound and much hæmorrhage; kept in bed, and able to get about in fifteen days. This cicatrix had been now torn across.
42	M., æt. 28, boiler maker.	Delicate, chronic cough, suspected phthisis, domestic troubles.	Slipped, and fell backwards, fracturing patella and tearing open partially cicatrised wound over patella, and fell on ground.	Transverse lacerated wound over front of knee-joint; starred fractured patella; finger introduced through wound and fracture into joint, and condyles felt. About two months before had a lacerated wound over front of knee-joint, which was nearly cicatrised when the present accident occurred, and was forcibly torn open.
43	F., æt. 30, married; domestic.	Good health, never had a day's illness.	Fell down stairs on both knees, striking right knee against edge of wooden stair.	Small transverse lacerated wound over lower part of patella; portion of latter broken off. Severe hæmorrhage; fainted

Treatment.	Secondary Effects, &c.	Result.	Reference.
Integuments brought together by silver sutures; immobility; irrigation.	No secondary effects; perfect union of skin, converting a compound into a simple fracture; joint free, and fairly movable. Recovered, with useful limb.	R	Holden, 1869; St. Barth. Hosp.; private communication, unpublished.
Parts placed in position, sutures, and strapping. Pillow splint and leg raised.	Union of wound by first intention; not slightest constitutional symptoms; able to walk at end of six weeks; perfect recovery; limb even more useful than before the accident.	R	Aldridge, 1869; Med. Times and Gaz., Oct. 30, 1869, p. 513.
Back splint, pad, bandage.	Went on well until end of second week; suppurating joint; incisions; abscesses in leg and thigh; amputation or excision refused; pyæmia.	D 7 wks.	Poland, 1870; Guy's Hospital, unpublished
Great difficulty in arresting hæmorrhage; pressure.	Inflammation, pain, and engorgement of knee and thigh; gangrene threatening; suppuration; incisions; fever; delirium. Death on twentieth day; no opportunity for amputation.	D 20 days	Pelletan; Clin. Chir., t. ii, p. 155.
Back splint, leeches; edges approximated by sutures.	Severe inflammation, and suppuration of joint; incisions; tonics; support. Ulceration of cartilages; threatening pyæmia. Health giving way; amputation on forty-fifth day. Recovery.	R	Poland; case cited 1869.
Kept in bed at rest; cold applications. Swelling and extravasation of blood, and sent to hospital on fourth day. Dilatation of wound by vertical incision, and removal of detached portion of patella. Back splint and strapping.	Never had a single bad symptom; no inflammation, no pain; patella movable, and no signs of anchylosis. Had a perfect and useful knee.	R	Hilton and Durham; Guy's Hosp. Sept., 1869, unpublished.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
44	M., æt. 40, warehouseman	Tolerably healthy, stout-ish, led very regular life, not had a day's illness for 12 years.	Thrown from horse.	Compound comminuted fracture of left patella. Immediate amputation proposed, but man would not submit. Patella broken in many places, and joint laid open.
45	M., æt. 30, tailor, in army.	—	Leaped over a bastion and fell 40 feet into a ditch whilst drunk.	Compound comminuted fracture of right patella, and joint laid open from condyle to condyle. The fracture was perpendicular, and in several small pieces. Other severe injuries.
46	M., St. Bartholomew's Hospital.	—	—	Compound fracture of patella.
47	M., J. D., private 49th regiment, æt. 29.	—	Struck by shell.	Componnd fracture of patella; partial.
48	M., æt. 20.	—	—	Compound comminuted fracture.

TABLE III.—*Compound fracture of the patella*

49	M., Crimea.	—	Gunshot ball.	"Starred" fracture of the patella without opening the joint. Ball did not lodge.
50	M., Mameluke.	—	Pistol shot.	Traversed knee and fractured the patella.
51	M., Lieut.-Col. at Waterloo, June 18.	—	Musket shot.	Entered onter side of right knee and lodged. A hard body presented itself on opposite side of knee, supposed to be the ball. Surgeon about to cut down on it when fire of enemy forced them to fall back on village of Waterloo. Amputation about to be performed, when orders for removal to Brussels.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Wound enlarged transversely, and the pieces comprising the whole patella were removed, with considerable portion of the attached ligamentous structures. Lint soaked in the patient's blood applied, straight splint, spirit lotion.	Considerable but not extraordinary constitutional irritation followed. Anodynes, vin. ant. p. tart., milk diet. On eighth day suppuration in middle of leg, opened, knee-joint granulating healthily. On thirty-first day abscess at outer side of thigh opened. Recovered perfectly, with straight anchylosis. Seen two years after; able to follow his former business.	R	Halton, 1828; Royal Infirmary, Liverpool, communicated by Long, the present Consulting Surgeon, 1870, unpublished.
Immediate amputation strongly urged, but not acted on. Limb extended and placed in fracture box; lips of wound united by four sutures, and compress dipped in blood placed over wound.	Violent reaction and swollen joint; ice applied; subsidence, and removal of sutures on fourth day, wound partly united; remained open at inner angle for many weeks, and gave exit to pieces of patella. Limb useful, and could be flexed as well as ever.	R	Madden; Med. Times and Gaz., Oct. 10, 1868, p. 416.
—	Recovered, with anchylosis, and had the use of the limb pretty freely.	R	Lawrence; Lancet, 1829–30, vol. ii, p. 320.
—	Invalided some time after, with some stiffness of the knee-joint.	R	Macleod; Notes on the Crimean War, p. 323.
Removal of whole of fragments of patella.	Extensive suppuration and pyæmia, death in four weeks.	D	Textor, fils, 1852; Günther's Operative Surgery; Fuchs, Diss., 1854.

associated with gunshot wounds.

—	Subsequent inflammation, slight; good recovery; motion of joint was considerably interfered with.	R	Macleod; Notes on Crimean War, p. 324.
Removal of all the fragments.	Some severe symptoms which yielded to treatment. Partial cure.	R	Larrey; Mem. de Chir. Méd., t. iii.
General and local depletion, cold, low diet.	Considerable swelling and inflammation subsided. Exploratory incision over prominence of supposed ball, and found to be fractured portion of patella firmly adherent; suppuration, and small pieces of patella came away. Recovery.	R	Hennen's Military Surgery, 1818, p. 162.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
52	M., æt. 15.	Strong, vigorous.	Ball struck knee.	Entered on inner side of knee without injuring condyle, traversed the middle of the patella, breaking it in pieces, and came out carrying fragments of bone with it at external part. Integuments in front of knee intact. Upper and lower pieces of patella left *in situ*. Apertures well marked.
53	M., young gentleman.	Good constitution, temperate habits.	Gunshot from fowling-piece. Right knee.	Extensive lacerated wound on outside of knee; appeared as if burnt. Patella almost entirely carried away, with exception of a small piece attached to the ligamentum patellæ. Femur, tibia, and crucial ligaments entire.
54	M., æt. 35, private in 20th regiment serving in India.	—	Gunshot wound of left knee.	Ball entered from behind, traversed joint, and shattered the patella on its exit.
55	M., poacher.	—	Gunshot wound of knee during struggle.	Patella reduced to fragments. No fracture of femur or tibia.
56	M., Prussian soldier, Flensburg.	—	Gunshot wound of knee.	The ball entirely comminuted the patella.
57	...	—	Conical bullet.	Lacerated wound like a grazing shot; struck anterior surface of patella obliquely; piece of bullet lodged in the patella. The ball had split after penetrating the bone, and the larger portion had passed on.
58	M., soldier 36th Ohio.	—	Gunshot.	Ball entered a little below centre of patella whilst in kneeling position, and passed through joint.
59	M., soldier 18th U. S. Infantry.	—	Gunshot.	Ball entered middle of patella, carrying away half, and passing out above external condyle.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Limb bandaged from s to groin, but relaxed next day.	Inflammation and swelling; suppuration; depôts opened; fistulous sinuses; counter-opening. Upper and lower fragments of patella became bathed in pus, detached, and were removed; eight months after walked without help. Enlisted in army and served two years.	R	Cambray, 1815; Journ. de Chir. de Malgaigne, Dec., 1846; Bull. Méd. du Nord.
Semiflexion of limb to ght extent; large doses opium; poultice was ntinually applied until nulations began to e.	No local or general symptoms; granulation sprang up; the remaining portion of patella removed; perfect recovery. Five months after able to ride on horseback; cicatrix firm; considerable motion in joint.	R	Ward, of Huntingdon, 1838; Guy's Hosp. Rep. Ser. 1, vol. v, p. 88.
—	Recovery, with anchylosis and atrophy of leg. Died twenty-six months after from abscess of liver. Fractured patella found consolidated by osseous matter and united to femur; capsule of joint obliterated.	R	Williamson; Descrip. of prep. of gunshot wound, Fort Pitt Museum, Plate IX, fig. 1; Prep. No. 2944.
Not stated. Was followed by suppurating nt, and deep-seated abesses in thigh and leg.	On twentieth day, when seen, large open wound, leg swollen, and seat of phlegmonous inflammation. Amputation refused. Resection performed; intense suppurative inflammation. In two and a half months able to get on crutches; limb shortened, rigid, and straight; anchylosis. No fistulous opening.	R	Verneuil, 1864; Bouchard, case 28, p. 89; La Societe de Chirurgie, Paris, April 27, 1864.
Amputation refused.	Recovery, with anchylosed joint.	R	Esmarch; Translated by Statham, p. 97.
Extraction of piece of let from patella with iculty some time after. d been treated with l applications.	Chronic inflammation and hydrarthrosis followed. Incomplete luxation of head of tibia backwards. Successfully treated by Strohmeyer's extension machine.	R	Ditto, ditto.
Cold applications.	Excessive inflammation and suppuration. Progressed favorably; every prospect of recovery.	R	Finley, 1863; Moses' Surgical Notes American War; American Journ., vol. xlviii, p. 363.
—	Inflammation and suppuration. The remaining portion of patella came away by ulceration. Progressed favorably, and well at seventh month, with anchylosis.	R	Ditto, ditto.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
60	Corporal Moses, æt. 34.	--	Conical bullet passed through knee from side to side.	Causing comminuted fracture of patella without injurying condyles or head of tibia.
61	M.	—	Gunshot.	Shattered patella.
62	Corporal Z., æt. 23, 6th regiment Wisconsin Vol.	—	Gunshot.	Compound comminuted fracture. Ball entered outer part of knee, shattered the patella, and passed out through an opening above the patella.
63	M.	—	Gunshot.	Crushing of patella into many pieces.
64	M.	—	Gunshot.	Ditto. No detail.
65	M., æt. 24, soldier 7th line	—	Gunshot.	Ball traversed left knee, and exit above internal condyle. Fracture of patella.
66	M., æt. 25, soldier 49th line.	—	Gunshot, left knee.	Comminuted fracture of the patella.
67	M., æt. 24, soldier 14th line.	—	Gunshot wound, left knee.	Lesion of patella; bone probably carried away.
68	M., æt. 30, soldier 61st line.	—	Gunshot, right knee.	Ball entered from below upwards, fractured external part of the patella, and passed out above joint at outer part of thigh.
69	M., æt. 37.	—	Gunshot wound, shattered joint.	Comminuted fracture.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Not seen until thirteen rs after.	Knee swollen, as also thigh; great constitutional disturbance, debility, and diarrhœa; too weak for amputation. Free incision on outer side of joint, and three pieces of patella removed. Diarrhœa continued. Death thirty-one days after injury.	D	Lidell; Amer. Med Journal, 1865, vol. xlix, p. 297; Amer. Army Department Circular, No. 6, p. 60.
Removal of fragments patella.	Inflammation and speedy death.	D	Theden Bemerk u. Erf., vol. i, p. 101; case seen by him.
Crawled half a mile and nained two days with- t treatment, and trans- red to hospital on nine- nth day.	Seven small pieces of loose fragments removed, joint suppurating. At end of five months in good condition, and with every prospect of a serviceable limb.	R	Amer. Med. Times, Jan. 30, 1864, p. 52.
Two pieces of detached inters of patella re- ved; leeches, &c.	Much constitutional and local disturbance; incision into deep-seated abscess; excessive discharge; exhaustion; amputation refused. Two more pieces of patella removed. At end of five months repair and complete anchylosis.	R	Demme; Mil. Chir. Late Italian Campaign, p. 269.
—	No detail; complete anchylosis.	R	Ditto.
—	Incomplete anchylosis; deep and adherent cicatrices.	R	Pensioners of the Crimean War; Chenu's Statistics, 1854.
—	Incomplete and bad consolidation, large adherent cicatrices, and loss of substance; atrophy of limb.	R	Ditto, ditto.
—	Loss of patella and adherent cicatrices; permanent straight joint.	R	Ditto, ditto.
Immediate extraction ball at inner part of igh.	Incomplete anchylosis, and knee bent so that he was unable to touch the ground except with the toes. Large adherent cicatrix.	R	Ditto, ditto.
Removal of whole frag- nts of patella.	Pyæmia, and death in seven days.	D	Textor, père, 1847; Gunther; Fuchs, Diss., 1854.

Analysis of the foregoing Tables.

I. Of the incised wounds followed by compound fracture there were 8 cases and all males; 6 recovered, 2 died.

The causes in 6 were from direct blows or lesion produced by cutting instruments, as the axe, hatchet, sabre, side-arm, and straw-cutting machine; and in 2 the accident was due to falls, one on the edge of a ship's cutlass from the mast of a ship; and the other from a fall off the bed on to a broken chamber utensil.

The knee-joint was laid open in all, with but one exception, viz. case No. 1; this is one of the only two instances of the whole series of cases in which this peculiarity occurred—a remarkable point which will be referred to at the end of the communication. This case, therefore, assumed the character of a non-penetrating wound, and gave rise to no serious alarm; bony union ensued and a perfect recovery resulted.

Of the 7 cases in which the knee-joint was laid open, 5 recovered, and these recoveries occurred in patients aged 6, 8, 11, 15, and the middle period of life. In three there was no inflammation or suppuration whatever, notwithstanding the removal of a portion of protruding condyle in one instance, No. 6, and in all three there was perfect union of the fracture with a moveable useful joint. The other two cases of recovery had suppuration supervene, of a trivial character in one instance, but in the other it was such as to require the removal of a portion of the patella to give vent to the accumulated pus in the joint.

The two deaths occurred, the one in a civilian, and the other in a grenadier à cheval; both these cases had suppurating joints and deep-seated abscesses along the thigh, and unfortunately no opportunity was afforded to perform secondary amputation.

II. Of the lacerated wounds associated with compound fracture of the patella there are 40 cases; 35 males and 5 females; 30 recoveries, 9 deaths, and 1 result not stated.

The causes may be arranged as follows:

a. Falls from a height on to the ground, uninterrupted;

Two from a warehouse into the street, Nos. 11 and 40.

One from a scaffold, No. 34.

One from a lofty window, No. 36.

One from a height of sixteen feet on to the ground, No. 22.

Two fell forty feet, one, No. 45, into a ditch, and the other, No. 21, into a pit on to a cask.

One fell sixty feet on to a rock, No. 23.

b. Falls from a height, but interrupted in descent, occurred in 2 cases, both falling through a skylight or grating on to the pavement, Nos. 14 and 37.

c. Falls from being thrown out of a vehicle, or from off a horse against some resisting body. Six cases, Nos. 12, 15, 20, 25, 35, and 44.

d. Two cases from falling down on edge of stairs and striking the knee, Nos. 39 and 43. In one, whilst going up, and in the other when coming down.

e. Direct blows from the kick of a horse in cases, Nos. 16 17, 24, and 29.

f. Direct blows from bodies thrown by explosion against the knee, in Nos. 18, 30, 31, 32, 33, 47.

g. Direct falling of heavy weight on to knee, No. 38.

h. From simply falling down whilst walking and striking the knee, Nos. 13, 28, and 41.

i. From muscular effort as asserted by the patient, case No. 42, the only instance of the kind, and is the one narrated in this communication, and which we have ventured to consider as very improbable.

In several cases the cause is not stated, viz., Nos. 9, 10, 26, 27, 46 and 48.

The 30 RECOVERIES have the following results:—

(*a*) GOOD MOTION OF THE JOINT, WITHOUT ANCHYLOSIS, and a perfectly useful limb. Ten cases, the ages varying between 30 and 48 years.

Of these 2 *were females*, æt. 30 and 38; in one, No. 43, there was a fragment broken off, which was removed at once; in the other, No. 25, the patella was broken into 5 pieces,

all of which were removed at once. In both the cases there was not the slightest inflammation or suppuration, and they were able to walk about at the end of four weeks.

Eight were males, ages being 30, 33, 35, 36, 39, 40, 48, and one middle aged. In not one of these cases was there any suppuration. See cases 12, 13, 15, 19, 20, 22, 38, and 45. Sir A. Cooper's case, No. 12, æt. 39, lived to the age of 89, with as useful a limb as the other.

(*b*) PARTIAL ANCHYLOSIS, and with a moderately useful limb in 5 cases.

One female, æt. 63, who had for some years previously been the subject of a diseased knee-joint, which resulted in a partial anchylosis of the knee. There was not the slightest inflammation or suppuration following the present injury, and the patient recovered with a more useful limb than before. See case 39.

Four males, æt. 20, 23, 25, and 29; three of these had severe and protracted suppuration of the joint and parts around, requiring the use of free incisions. Cases 21, 23, 29 and 47.

(*c*) COMPLETE ANCHYLOSIS in 11 cases, the recovery being more or less prolonged after protracted suppuration, &c., ages 20, 23, 26, 28, 28, 40, 45, and four not stated. In 8 the anchylosis was recorded as straight. See cases 11, 24, 26, 27, 31, 32, 33, 37, 44. In 1, No. 18, æt. 45, the knee was slightly bent. In 1, No. 31, æt. 20, the anchylosis was attended with permanent flexion of the leg on the thigh, and atrophy of the limb.

(*d*) SECONDARY AMPUTATION in 4 cases.

One female, æt. 34, performed on the 25th day. See case 36.

Three males, one a brigadier, age not stated, and operated upon on the 24th day, case 16; the second, æt. 28, on the 45th day, case 42; and the third, æt. 26, at the end of four months, case 28.

THE 9 DEATHS occurred as follows:

One female, æt. 19, who had a suppurating joint, and symptoms of phthisis. See case 14.

Eight males, æt. 20, 26, 29, 35, 37, and 51; in 2 the ages not stated. Cases 9, 10, 17, 34, 35, 40, 41 and 48.

With one exception all the above cases died of exhaustion consequent upon the suppurating joints and deep-seated extensive abscesses of the thigh and leg, or from pyæmia, and where no opportunity was afforded for performing any operation.

In the exceptional case, No. 35, æt. 29, secondary amputation was performed on the eleventh day, and death resulted five days afterwards.

One case result not stated; the only record being that at the end of six weeks if any union had taken place it was very slight. See case 30.

The three additional cases of recovery stated to be recorded by Post, of New York, are not included in the above analysis.

III. Of the gunshot wounds, associated with compound fracture of the patella, there were 21 cases, all males, eighteen recoveries and 3 deaths.

These statistics must on no account be taken as showing the ratio of mortality, for doubtless there are many unrecorded deaths; and, again, the returns of killed and wounded specify only lesions of the knee-joint, without any reference to the individual parts of the structure of the joint; and are generally classed as penetrating and non-penetrating wounds. We must also recollect that it is the successful cases which find their way into the public journals, and hence the large proportion of recoveries in our present table. However, as far as information permits, we have the following deductions:

Of the 18 recoveries—

(*a*) *Good motion, and a useful limb without anchylosis*, in two cases, both young persons, and both lost their patellæ. The one, æt. 15, case 52, had fragments of the patella come away at the time of the accident, but the greater portions of the bone were removed secondarily when suppuration was fully established, and the pieces lying bathed

in pus; he entered the army afterwards, and served two years. The other case, No. 53, had nearly the whole of the patella shot away at the time of the accident, and he in the course of five months was able to ride on horseback.

In case 49 we meet with an example similar to No. 1, where there was a compound fracture of the patella without opening the joint, but in this present instance the subsequent motion of the joint was considerably interfered with.

(*b*) *Partial or incomplete anchylosis,* mentioned in 3 cases, Nos. 50, 65, 66, in a Mameluke, and in young soldiers, æt. 24 and 25, and in these latter two the repair was anything but satisfactory, there being large adherent cicatrices, and atrophy of the limb in one.

(*c*) *Permanent or fixed anchylosis* in 8 cases. Of these *the anchylosis was straight* in 3, cases Nos. 54, 55, and 67. In one the patella became adherent to the femur, and the leg atrophied; in the second, resection of the knee-joint was performed, although the femur and tibia were uninjured, which gave rise to much comment; the man had a suppurating joint and deep-seated abscesses in the popliteal space; he was exhausted, and amputation earnestly demanded; he refused to lose the leg, resection was therefore performed, and in removing the upper part of the tibia a large deep-seated collection of pus was set free; there was subsequently 1½ inch shortening. The third case occurred in a soldier, æt. 24, where the whole of the patella was lost.

The limb was anchylosed in a flexed position in one case, No. 68, so that the patient could only just touch the ground with his toes.

The condition of the anchylosis is not mentioned in four cases, Nos. 56, 59, 63, and 64; in one of these, No. 59, the patella was lost, part at the time of the injury, and part by suppurative action in joint.

(*d*) In four cases the condition of the joint is not accurately defined, Nos. 51, 57, 58, and 62.

No. 51 is very similar to case 59, part of the patella being shot away, and the remaining portion coming away secondarily by ulceration and suppurative action in the joint.

No. 57 had subsequently hydrarthrosis and incomplete luxation of the head of the tibia, requiring the application of an apparatus to fix the joint.

In two cases, Nos. 54 and 55, there ensued atrophy of the leg.

The 3 DEATHS took place in cases 60, 61, and 69; in the latter two the shattered patella was removed by the surgeon, and was followed by inflammation and speedy death in the one instance, and pyæmia on the seventh day in the other. The third case was a corporal, æt. 34, who did not come under treatment until the thirteenth day, when he was suffering from a suppurating joint, debility, and diarrhœa. He was too ill for any operative measures, and died thirty-one days after the injury.

General Summary of the conditions of the fracture in the foregoing cases.

1. *Single fracture, or fracture in two pieces,* 24 cases.
   (*a*) *Transverse* fracture in 14 cases, Nos. 1, 3, 4, 8, 9, 17, 19, 21, 23, 28, 38, 39, 40, 41.
   (*b*) *Oblique* fracture in 3 cases, Nos. 2, 7, 24.
   (*c*) *Vertical* fracture in 3 cases, Nos. 5, 14, 18.
   (*f*) *Small fragment* knocked off in one case, No. 43, and remained firmly adherent in another, No. 51.
   (*g*) Direction and condition of fracture not stated in 1 case, No. 47.
   (*l*) Splitting of the patella upwards into an anterior and posterior portion by an axe in one case, No. 6.
2. *Fracture into three or four pieces,* probably starred in 5 cases, Nos. 34, 37, 42, 46, and 49.
3. *Comminuted fractures* in 25 cases.
   Fourteen associated with lacerated wounds, see cases Nos. 12, 13, 15, 20, 22, 25, 26, 27, 29, 33, 35, 44, 45, 48.

Eleven associated with gunshot wounds, Nos. 52, 54, 55, 56, 60, 61, 62, 63, 64, 66, 69.

4. *Patella shot away* in two cases,—Nos. 53 and 67.

5. *Patella in part shot* away in two cases.

Case 68, the external part; in case 59 one half carried away primarily, and the other half detached secondarily.

6. *Bullet lodged* in patella in one case, No. 57, here only a piece of it lodged, the other portion splitting the bone and penetrating.

Condition of the fracture not stated in 10 cases; cases 10, 11, 30, 31, 32, 36, 46, 50, 58, 65.

General Summary of the Treatment adopted in the sixty-nine cases of Compound Fracture of the Patella.

For the most part these cases were treated on the same principle as for ordinary simple fracture of the bone as far as regards the fracture.

In respect to the wound complication very little satisfactory detail is given:

In the incised wounds sutures are mentioned to have been used in 3 cases, but apparently with no beneficial effect; and in the lacerated wounds sutures were used in 7 cases with beneficial effect, and union of edges in 3 cases, but the other 4 without any good resulting.

The ordinary methods of treating wounds of joint were generally employed, such as strapping where permissible, application of ice, leeches, irrigation, &c., and in the suppurating stage by fomentations and free incisions, opium tonics and support, &c.

In two cases, Nos. 22 and 23, drainage tubes were used and with beneficial effect.

In two cases, Nos. 37 and 57, the ligaments about the joint became lax, so as to threaten and cause partial displacement, requiring support and instruments to counteract.

The removal of the fragments of the patella occurred

in 20 cases. Primary removal in 11 cases, of which 3 were fatal. Secondary removal in 9 cases, of which 1 was fatal.

In one case, No. 57, secondary extraction of a piece of bullet from the patella was successful.

Amputation urged and not consented to by the patient in 4 cases; two recovered, Nos. 45 and 56, two died, Nos. 34 and 40.

Amputation decided upon, but no opportunity afforded in two cases, Nos. 17 and 41, who succumbed.

Secondary amputation in 5 cases, 4 recoveries, Nos. 16, 28, 36, 42,—1 death, No. 35.

Secondary excision of knee-joint in 1 case with recovery—case 55.

Conclusions.—In reviewing the foregoing cases with their analysis, we may safely state—

1. That compound fractures of the patella are not necessarily mortal injuries, and do not require immediate amputation or resection, except when complicated with other injuries of the joint structure. In this latter case the injury done to the integuments and surrounding tissues are such that amputation is preferable to excision.

2. In all cases we should attempt to save the limb, and adopt the ordinary treatment as for simple fractures of the patella, whether comminuted or otherwise. The wound should be accurately closed by sutures, but employed with judgment, strapping and relays of ice should be constantly used.

3. That when suppuration fully sets in, and which must always be expected in severe laceration and in patients of unsound constitution, we must not hesitate for one moment to make free incision into the joint. Drainage tubes may be used, but they are unnecessary.

4. Amputation or resection is only to be resorted to when the powers of the patient fail to repair the injured joint.

5. The extraction of fragments has been resorted to both primarily and secondarily with success; but as a rule detached and loose portions had better be removed at once, providing this does not necessitate further injury to the

joint: if attached, and firmly adherent, they had better by far be left to take their chance of co-adhesion, or to be thrown off and detached during the suppurative process.

With regard to the repair of compound fracture of the patella little information can be gained from the cases, inasmuch as but slight allusion has been made to it in the records, and therefore not much is added to what is generally known on the subject.

The mode of union has been mentioned in a few of the cases, thus: under-*incised* wounds in cases 1, 6, 7, 8, where the edges of the bone are stated to be perfectly united: but whether ligamentous or bony is not alluded to: under *lacerated wounds*, cases 12, 13, and 15, all comminuted fractures, are reported to have had perfect osseous union of the fragments; in case 19 the transverse fracture was united by fibrous callus, when some months afterwards he met with a fall and ruptured his fibrous callus, but with complete immobilization, good union again occurred. In case 42, one of starred fracture, and examined after removal of the limb, repair by means of osseous material was in process.

Suffice it to say that it is most probable that in many of the cases, and more especially in the comminuted fractures, bony union took place.

Compound fractures arising, for the most part, from direct violence, whether caused by incised, lacerated, or gunshot wounds may, as we have seen, be attended with every variety in the direction and character of the fracture; thus, it may be transverse, oblique, vertical, starred, broken into single or many fragments. Now in all these (excepting the transverse variety) being for the most part uncomplicated with muscular contraction, the fracture remains *in situ*, and the external fibrous tissue in front generally escaping entire division maintains the fragments in position, and a good coaptation results,—a condition favorable for bony union; hence, in the majority of these instances, we may expect and do most probably have bony union. In gunshot wounds the wound in the membrane corresponds to the size of the ball, although the bone may be extensively comminuted, and this fibrous tissue, being

thus left almost entire, tends to preserve the coaptation of the fragments.[1]

Mr. Hutchinson,[2] in his observations on Fracture of the Patella, has alluded to the repair of the fracture under consideration. See Proposition VII.

"It appears, then, that osseous union is to be expected where there is perfect coaptation of the fragments, and where the integrity of the aponeurosis or fibrous investment in front of the bone is maintained.

Appendix of Cases of compound fracture of the Patella associated with lesion of the other bones entering into the composition of the knee-joint. There are 16 cases, and numbered from 70 to 85.

These do not, properly speaking, strictly come under our present consideration, inasmuch as they belong to compound fractures of the bones of the knee-joint, and not to one isolated bone, as the patella. Still we have considered it necessary to introduce such few of the cases as stand upon record in association with the subject of compound fractures of the patella, more especially as they may assist us in some measure respecting the treatment which may be adopted. The cases of this description are rarely met with in civil practice, and, therefore, we must look to our naval and military confrères for evidence in the treatment of such injuries, not only in respect of saving the limb, but also as to the value of resection of shattered bones at joints. Unfortunately but few records have been furnished during recent wars in Germany, Schleswig-Holstein, Italy, India, and America. Resection and attempts to save joints have been undoubtedly frequent among the enormous number of wounded soldiers throughout these great battles, yet we have only a few meager unsatisfactory details of any cases, and we have therefore given a brief summary of what is at present recorded for our instruction.

[1] 'Med.-Chir. Trans.,' vol. lii, p. 328, 1869.

[2] See Gulliver's "Experiments and Observations concerning Fractures of the Patella." 'Edin. Med. and Surg. Journal,' vol. 47, p. 160, 1837.

TABLE IV.—*Contused and lacerated wounds with compound*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
70	M., æt. 19, soldier 2nd Voltigeurs.	—	Bursting of shell.	Fracture of condyle of femur, and of patella.
71	M., æt. 25, Light Artillery.	Robust.	Fell from first floor on to pavement.	Comminuted fracture of right patella and femur, as also lower jaw; with other external injuries and bruises.
72	M., private, 3rd Light Dragoons.	—	Gunshot carbine.	Whilst knee in bent position, ball entered and comminuted the point of the patella, and lodged between the condyles of the femur, splitting it.
73	M., soldier.	—	Gunshot.	Comminuted patella and fractured head of tibia.
74	M., æt. 35, house painter.	Nervous.	Ball traversed left knee.	Ball fractured the patella, the condyle of the femur, and passed out through popliteal space without wounding vessels or nerves. Patella comminuted.
75	M., æt. 25, soldier Chasseurs.	Rather slender.	Ball traversed knee.	Carried away a small fragment of upper part of patella, luxated bone outwards, and broke a portion of external condyle of femur.
76	M., æt. 15.	—	Gunshot, 4 paces off, 1 bullet and 40 small shot in gun.	The ball entered anterior and lateral part of right knee, fractured the patella and condyles of femur, and passed out at inner side of thigh above condyle, and entered into lower part of left thigh near the popliteal vessels, and then made its exit.
77	M., captain of Algerine vessel.	—	Small bullet wound.	Carried away 3 inches of upper part of tibia, a small portion of inferior part of patella, head of fibula, and a small portion of condyle of femur.
78	M., æt. 38, soldier 3rd Pennsylv. Cavalry.	—	Gunshot.	Right patella comminuted, and a compound fracture of the joint.

ractured patella and fractured condyle of femur.

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	Incomplete anchylosis, with permanent extension. Shortening of limb.	R	Chenu's Statistics; Bouchard, p. 37.
Free incisions. Desult's splint.	Inflammation, suppuration, depôts, incisions. Hæmorrhage from wound in thigh; disorganisation of tissues. Death on twenty-second day.	R	Henot; Recueuil des Méd. de Méd et Chir. Milit., 1825, vol. xviii, p. 164; Bouchard, case 11, p. 31.
Amputation of the thigh 4 hours after injury.	——	R	Williamson on Prep. of Gunshot Wound in Fort Pitt, Chatham; Plate VIII, fig. 4, Prep. 2933.
Free incisions into joint nd extraction of fragents of patella with head f tibia, and removal of he semilunar cartilages.	Inflammation and disorganisation of joint; surface of synovial membrane painted with tincture of iodine, and articular surfaces of condyles scraped off. Lived twelve days.	D	American War Circular, No. 6, p. 60; Assist.-Surg. Siebold.
Amputation urged and fused. General and local plation, cold, straight int.	Violent inflammation and suppuration; fever. Secondary amputation on eighth day. Pyæmic symptoms, and death in four weeks.	D	Sanson; Lancette Française, Nov. 9, 1830; Bouchard, case 6, p. 21.
Not seen till fourth ay.	Enormous swelling of leg and thigh; intense inflammation and fever; free incision; leeches; removal of pieces of bone. Recovery in forty-five days, with limited motion of joint.	R	Alquié; Recueuil de Mém. de Méd. et Chir. Milit., 1825. t. xvi, p. 6.
Wound dilated; clothg and three pieces of ne removed; seventeen ts extracted from diffrent parts of thigh, and rteen more removed by cisions.	Knee swollen and tense; inflammation, convulsions, suppuration, subsidence of symptoms, abscesses, detachment and casting off of ten bony splinters, injections, compression, &c. At end of three months perfect cure without anchylosis.	R	Dessault, Chir. Journal, English Translat., vol. i, p. 306; Thiebault's case, 1791.
Repeated bleedings, irit lotion.	Intense pain, inflammation, and fever; swelling; convulsions; removal of splinters; abscesses; exfoliation. Recovery protracted, with anchylosis.	R	Percy, Chir. d'Armée, 1792, p 263.
Seen on tenth day. ion half an inch of femur, nd of tibia, and patella re removed	Parts swollen, and patient prostrated at time of operation; profuse suppuration; purulent infection. Death eleven days after operation.	D	Bentley, U. S. Vol. American War Circular, No. 6, p. 59.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
79	M., æt. 19, soldier 2nd Michigan Vol.	—	Gunshot musket ball.	Ball shattered left knee and fractured patella on right side, laying open the joint.
80	M., soldier 1st Missouri Militia.	—	Gunshot.	Ball fractured patella and external condyle of femur, and lodged in tibia.
81	M., soldier 49th Georgian	—	Gunshot wound, conoidal musket ball.	Ball fractured the patella and external condyle of femur.
82	M., æt. 27, carpenter.	Healthy.	Gun charged with shot and slugs, contents entered outer side of lig. patellæ, and exit above patella.	Patella shivered into innumerable pieces, but the skin over it remained entire, though scorched and blackened. Finger introduced through entrance wound, and extensive injury of condyles of femur detected. A spiculum of patella extruded 1 inch through exit opening.
83	M., æt. 60, a preacher.	—	Circular saw, producing a kind of partial excision of knee.	Infliction of several injuries, and among which was the left knee. The patella was torn into small pieces and entirely removed, together with ¼ inch of condyles of femur, leaving a flat surface. Flap of skin left to extent of 1½ inch. Saw did not pass through joint.
84	M., æt. 19, Sergeant Mahony, 15th Mass. Vol.	—	Gunshot.	Ball entered outer side of left knee passed through and entered the right knee fracturing patella, and then through external tuberosity of the tibia, and lodged in head of fibula.
85	M., æt. 31, private 47th regiment.	—	Grapeshot.	Entered outer side of lig. patellæ, passed up through joint, shattered patella, and making exit at anterior part of thigh, partially fracturing femur at its middle.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Left thigh amputated immediately; right joint excised on sixth day; joint disorganized, and head of tibia grazed.	Shattered patella removed, as also two thirds of condyle, of femur, and articular surface of head of tibia. Death in thirteen days.	D	Bontecon, U. S. Vol.; Amer. War Circular No. 6, p. 59.
Resection on seventh day, when much suppuration, and pus evacuated.	Progressed slowly. At end of nine months walked perfectly well. Case not considered authenticated.	R	Assistant-Surgeon Thorne, U. S. A.; ditto, p. 59.
Incision of knee on sixth day; half an inch of femur, half an inch of tibia, and whole of patella, removed.	Intense inflammation and suppuration; great suffering. Rallied. Death eight days after operation; no attempt at reparation.	D	Rush, Surg. 1st Pennsylv. Vol.; ditto, p. 60.
As he was in profound sleep from drink, projecting portion of patella removed, and on the following day excision of the knee-joint performed, and careful removal of *débris* of patella.	Complete recovery, with one and a half inch shortening.	R	Thompson, Dublin Journal, 1868, vol. xlvi, p. 27.
Fragments of broken bone removed, and, where adherent, divided by scissors. Flap closed and brought together by ten sutures. Straight position, and in leg box.	Union of edges of wound by first intention; sutures removed on seventh day; no bad symptoms; improved rapidly; could walk freely, and often without stick.	R	Alexander, 1855; American Med. Jour., vol. xxxii, p. 558, 1866.
Seen on fifteenth day. Still removed from head of fibula, and several loose fragments of tibia and patella removed.	There was copious suppuration, the wounds healed kindly, and at the end of four months every prospect of serviceable limb; no shortening.	R	American Medical Times, January 30, 1864, p. 52.
	In the course of the treatment a greater part of the patella was removed, as well as fragments of femur. Firm union of femur, and anchylosis of knee resulted. He could bear his weight on limb, and walk without crutches.	R	Macleod; Notes on the Crimean War, p. 311.

The foregoing table thus comprises 16 cases, and all males; of which there were 10 recoveries and 6 deaths.

Of the CAUSES, one, No. 83, was produced by an incised wound inflicted by the circular saw of a straw-cutting machine.

Two were associated with lacerated wounds, No. 70 from the bursting of a shell, and No. 71 from the effects of a fall out of the first floor on to the pavement.

Thirteen were gunshot wounds, 8 recoveries and 5 deaths.

The adjoining bones implicated were chiefly those of the condyles of the femur, either one or both, but there is no very accurate statement on this head.

The patella itself was comminuted in 11 instances; a portion only broken off in 2 cases, and in 3 not stated.

OF THE 10 RECOVERIES—

a. Good union without anchylosis in 2 cases.

One æt. 60, case 83, where all the fragments were removed by the surgeon and where no inflammation followed.

The other æt. 15, case 76, after primary removal of the fragments and where no suppuration of the joint ensued.

b. Partial anchylosis in 2 cases.

No. 75, æt. 25, where primary and secondary removal of the pieces of bone was performed, and recovery was complete in 45 days.

No. 70, æt. 19, with extension and shortening.

c. Complete anchylosis in 2 cases.

No. 77, after most extensive injury, and secondary removal of splinters and exfoliation.

No. 85, æt. 31, after secondary removal of fragments of patella and femur.

d. Resection in 2 cases.

Primary No. 82, æt. 27, with anchylosis and 1½ inch shortening.

Secondary on seventh day, No. 80, and at the end of 9 months walked perfectly well. This case is not considered to be authentic, although generally quoted.

e. Removal of ball from head of fibula and fragments of patella and tibia in 15 days, case 84; prospect of serviceable limb.

f. Amputation—primary 24 hours after injury—case 72.

Of the 6 Deaths—

One No. 71, æt. 25, died from exhaustive suppuration on the 22nd day.

Four had resection of the joint performed. Of these, one was primary, but only partial, and proved fatal on 12th day, case 73.

Three secondary, one performed on the 6th day and fatal 13 days after, case 79. One performed on the 10th day, and fatal 11 days after, case 78. One performed on the 16th day, and fatal 8 days after, case 81.

One had secondary amputation performed on the 8th day and fatal in 4 weeks, case 74.

Table of General Summary of Results.

Number of cases.	Classes of Injury of Compound Fracture.	65 Recoveries.								20 Deaths.				
		Without anchylosis.	With partial anchylosis.	Complete anchylosis.	Condition not stated as regards joint.	Resection.		Amputation.		No Operation.	Resection.		Amputation.	
						Primary.	Secondary.	Primary.	Secondary.		Primary.	Secondary.	Primary.	Secondary.
8	Incised wounds	5	—	1	—	—	—	—	—	2	—	—	—	—
40	Lacerated wounds	10	5	11	1	—	—	—	4	8	—	—	—	1
21	Gunshot wounds	3	3	7	4	—	1	—	—	1	2 Removal of shattered patella.	—	—	—
16	Complicated with fracture of other bones of joint.	2	2	2	—	1	1 1 ball from head of fibula,&c.	1	—	1	1	3	—	1
85	Total	20	10	21	5	1	3	1	4	12	3	3	—	2

The three recoveries recorded by Post, of New York, are not included in the above table.

Suppuration of the joint occurred in 43 cases out of the 65 recoveries, and in all the 20 cases of death. Of the 22 cases without suppurating joint, we must exclude 2 cases of primary operation, and 5 cases where the state of the joint is not mentioned, thus leaving 15 cases only.

Question open for Inquiry.

Can there be a compound fracture of the patella without involving the knee-joint?

This question is raised by the case related by Mr. Travers, jun., in his 'Observations in Surgery,' p. 17, published in 1852, No. 1 of our present table, where a sailor fell from the mast of an East Indiaman, striking his knee against a ship's cutlass, producing a clean incised wound through the patella without involving the joint, and again by the case related by Mr. Macleod, No. 49 in our table; at page 324 of his work he says, "I have seen only one case in which the patella, being fractured by a ball, the joint was not at the same time opened. The bone was in that case starred, but the ball did not lodge. These two cases are quite sufficient in answer to the question raised, and in order to confirm these I have instituted several experiments on the dead body in order to ascertain this fact. The great difficulty was to produce a fracture of the patella, either in the straight, semiflexed, or extremely flexed position, and even when the patella was fixed in either of these conditions. I used a sharp-edged chisel and a mallet, and succeeded in one instance only in producing a fracture without injuring the cartilaginous coating of the posterior aspect of the patella: the force required was so great as to break through the patella totally, and expose the interior of the joint. I therefore adopted a less severe measure by partially sawing through the patella transversely across its middle, and then forcibly fracturing it by the chisel and mallet, taking care only to splinter the bone. I performed only a few experiments of this kind, and succeeded in breaking through the bone without opening the joint in several instances, thus showing that the posterior lining of the patella is capable of remaining entire, when the bone is completely broken through.

CASE

IN WHICH

A PLATE WITH ARTIFICIAL TEETH

WAS

SWALLOWED, DETECTED IN THE STOMACH, AND EXTRACTED.

BY

LOUIS STROMEYER LITTLE,

LATE ASSISTANT-SURGEON TO THE LONDON HOSPITAL.

COMMUNICATED BY

T. B. CURLING, F.R.S.

Received December 9th, 1869.—Read February 8th, 1870.

H. K—, a woman, æt. 40, was admitted into the London Hospital on the 2nd of January, 1864. Two days before her admission the patient, whilst in an epileptic fit, swallowed a gold plate with five artificial teeth attached to it, and with three sharp hooks to fix the plate to the natural teeth. On recovering from the fit she felt a good deal of pain when attempting to swallow, but succeeded in eating a considerable quantity of new bread, as she was recommended to do. She shortly afterwards vomited up the bread, and had not been able to keep down any food, either solid or liquid, since

the accident; she therefore came to the hospital. The house surgeon easily passed a probang into the stomach, and felt and heard it strike against a hard body. An emetic was given without result. The next morning I saw the patient and sounded the stomach with an ivory-tipped whalebone probang, and at once detected a metallic or hard body. I then introduced the coin-catcher, a whalebone probang with a split ring opened out so as to form a hook at its end, and after several attempts drew up with very little resistance as far as the pharynx, what proved to be the plate with the teeth attached. The plate could now be felt with the tip of the finger when introduced as far as possible, but every attempt to bring it further without force failed. Various curved forceps were tried, but ineffectually, as they slipped off the smooth surface which seemed uppermost. The plate was moved a little with each attempt, but was then drawn down again and impacted in the same place. The patient now became much distressed in her breathing, the plate probably pressing on and fixing the larynx, so that it was necessary to move the plate either upwards or downwards. I therefore again introduced the coin-catcher, passed the plate, and with a little force removed it.

The patient spat up some frothy mucus, tinged with blood. She was much relieved when the operation was over, and pleased at its result. The plate was much bent, probably by the forceps, and reduced in diameter, so that it was at last the more easily extracted.

She was ordered ice to suck, and to take twenty drops of laudanum.

January 4th.—She complained that her throat was very sore, and that she could scarcely swallow. There were no signs of local or general ailment. The next day she could swallow fluids with care, but said she brought up a great deal of phlegm. During the following week she complained of a lump in her throat, which was referred to about the level of the thyroid cartilage on the left side, but by the 20th inst. she could eat quite well. The foreign body consisted of a gold plate, curved in form so as to fit the front of the jaw,

and made to sustain five artificial teeth, three incisors, a canine and a bicuspid. It measured one inch and three quarters in its greatest length, and an inch and a quarter in its greatest width.

At one extremity there were two projecting hooks for attachment to the adjoining teeth, one of which was very sharp and prominent; the other was curved, and also sharp pointed. At the opposite extremity there was only one short curved hook.

When I was called to this case, the question arose whether I ought to attempt to remove the teeth or not. Of their presence in the stomach there could be no doubt. They had been there three days without passing any further, and they caused so much irritation as to prevent the retention of food in the stomach. During this period, notwithstanding frequent vomiting and the action of an emetic, the teeth had not been removed upwards. It seemed, therefore, probable that they would remain in the stomach, and not only interfere with its functions but also injure its walls. From these considerations the removal of the foreign body, if it could be effected without force, seemed desirable; and as the teeth had already passed the cardiac orifice of the stomach, they would in all probability re-pass through the œsophagus with ease. After several attempts at removal, it was clear, on withdrawing the hooked probang, that it had caught hold of something which followed it so readily that there seemed no reason to stop, and when once the teeth reached the

neck the chief reason for anxiety was at an end: viz., that of their becoming impacted in the œsophagus where they could not be got at from without.

Mr. Pollock's experiments* go to show that even a small plate with sharp points will not pass beyond the stomach, and this case is confirmatory of his experiments. In a similar case, then, the surgeon, when satisfied that the teeth are in the stomach and that they will not in all probability be removed by nature, should attempt their extraction with the assurance that if they will pass the cardiac orifice of the stomach without force, they will pass through the whole œsophagus.

* Vide 'Lancet,' April 10, 1869, p. 490.

ON

EXCISION OF THE JOINTS FOR DISEASE,

AND SPECIALLY OF THE

KNEE, HIP, AND ELBOW;

WITH

THE HISTORIES OF TWENTY TYPICAL CASES AND THEIR RESULTS.

BY

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SURGEON TO THE ROYAL FREE HOSPITAL.

Received March 8th.—Read April 12th, 1870.

Whenever a limb is the seat of disease or injury, incurable except by the surgical operation of removal, to save the limb by the partial operation of excision or cutting out of the part, rather than sacrifice the whole limb by amputation, should ever be one of the principal objects of surgical practice. It is thus that joints and bones may be extirpated for disease or injury respectively, leaving the limb still a useful member, and permanently so for life.

In regard to diseased joints, the revival of the operation of excision of the knee-joint by Sir William Fergusson in 1850,

and previously that of the hip-joint by the same eminent surgeon in 1845, gave the impulse to this aspect of modern operative surgery—an impulse which was, indeed, anticipated by the revival of excision of the elbow-joint by Mr. Syme in 1830. Since these periods there has been a growing tendency in surgical practice to similar operations for the removal of such diseased parts rather than have recourse to amputation, when the conditions of disease are incurable otherwise than by operative interference. Quite recently two valuable contributions of numerous cases were brought before this Society by Mr. Henry Lee and by Professor Humphry, of Cambridge, the record of which will be found in the last volume of the 'Transactions.'

On the other hand, there are yet some well-known surgeons of repute who, whether from the force of habit in favour of an old operation or from objections grounded on experience adverse to excision, still incline to amputation.

A series of twenty consecutive cases, wherein I selected the operation of excision for disease of the knee-, hip-, and elbow-joints, may, therefore, prove interesting, partly on account of their almost unexceptionally successful results. But the primary importance of these cases will be their *typical* character, as affording illustrations of the principal *pathological conditions*, both local and constitutional, in which the same operation can be justifiably practised in other cases with the probability of success.

Having this end specially in view, I would, in the first place, submit to the consideration of the Society the conclusions to which I have been led respecting the conditions of disease and of its results which are appropriate for excision of the joints in *general*, and which, so far as they may stand the test of experience, may be regarded as principles or rules for the guidance of the surgeon in his selection of this operation. As applicable to each of the three joints—the knee, hip, and elbow—which form the subjects of this paper, the special conditions of disease which seem to be appropriate for their excision, in *particular*, will be stated in connection with each series of cases adduced.

The conditions of diseased joints, eligible whether for the operation of excision or of amputation, are those which are incurable by non-operative treatment. But in what does such incurability consist? The whole diversity of opinion and experience among surgeons in regard to the propriety of excision *versus* amputation, springs from a twofold view of the nature of the state in question. Thus scrofulous disease of the hip-joint affecting the head of the bone and the acetabulum may be considered incurable by non-operative treatment, when the disease has advanced to destruction of the articular cartilaginous surfaces without the supervention of anchylosis, so that the part has become functionally useless. Or the same disease may not be regarded as incurable until it has advanced to a further and even an extreme state of disorganisation — dislocation, partial or complete, abscess, sinuses, profuse and long-continued discharge, with the constitutional disturbance of hectic and exhaustion. Now, the turning point of distinction between these two opposite states of the same disease is this—in the one case the joint has become functionally useless, in the other to this condition is generally superadded a constitutional state of exhaustion, which leaves no period of time nor of vital reserve-power sufficient for any prolonged process of reparation after operation. Yet this measure of time and of reserve-power are the essential elements of that reparative process which will inevitably be necessary to effect osseous or ligamentous union, as the case may be, and thence a successful result after *excision*.

Accordingly, compared with *amputation*, the performance of excision under the adverse circumstances of *advanced* disease will be singularly unsuccessful. The deliberate postponement of excision until that period when constitutional exhaustion with emaciation is verging on dissolution, would be almost equivalent to operating on a corpse. By analogy I would liken it to the postponement of operation for the relief of strangulated hernia until the patient is sinking in consequence, the surgeon deliberately allowing the expenditure of the natural reserve power requisite for recovery,

without which operative interference must necessarily be a failure and the patient doomed.

As determining the propriety of excision in the *course* of joint disease I would, therefore, define *incurability* by non-operative treatment to signify; that condition of the local disease wherein the joint has become *functionally useless* by destruction of the articular cartilages without the supervention of anchylosis, but while the constitution still retains the reserve power requisite for the long period of reparation necessary to effect union after removal of the diseased part—a period averaging three months for the knee and hip, and six weeks for the elbow.

But anchylosis might possibly take place *naturally* in some cases, and it should be well considered whether any advantages would accrue to the patient from this event as a natural cure, compared with the result of excision when successful; for I know of no data by which to compare the relative mortality of the two modes of cure—nature *versus* excision.

What, then, are the changes which the joint and constitution undergo in the course of natural cure by anchylosis? In the joint there is a twofold process of destruction and reparation. A piecemeal or molecular excision, so to speak, is constantly progressing, apparently by absorption and certainly by the draining away of débris of bone in the discharge until two healthy opposed surfaces are reached, so that union may at length be effected. This natural cure of joint disease entails a protracted period of recovery, extending even to many years as compared with that of weeks or months required for recovery after excision. During this ordeal the constitutional vigour is reduced, subsequently leaving the patient stamped with the aspect of suffering in former years. Occurring also as it often does during the growing period of life, the reserve power which should have been gained to meet the exigencies of after-life is used up prematurely by incessant demand in the long process of reparative anchylosis. Persons who have undergone the natural cure of diseased hip-joint, for example, may be seen hobbling about the streets, being

easily recognised by the characteristic gait of old-standing hip disease, and by their sallow and prematurely aged appearance.

This constitutional decrepitude may possibly be averted by a remarkable acceleration of the excisional part of the process. In a case represented by specimen No. 7 of the hip-joint series, an eminent surgeon differed with myself and others respecting its diagnosis; nature subsequently undertook the operation of excision *en masse*, for she severed and discharged the greater portion of the head of the femur through one of the fistulous tracks. This natural excision of a joint—the only one, I believe, on record—will be singularly suggestive to operative excisionists, and it should be equally admonitory to those surgeons who blindly oppose the operation.

The necessity for excision *after* the result of natural cure will depend on the failure of anchylosis to restore a functionally useful limb; in consequence either of an unsuitable kind of anchylosis, or an anchylosis with mal-position of the limb.

General Conditions of Diseased Joints appropriate for Excision.—In accordance with the foregoing considerations, the general condition which may be here designated *functional inutility* of a joint,—whether as the result of persistent disease, or of any failure of the natural cure, comprises three conditions:

Firstly, destruction of the articular cartilages, and perhaps dislocation, without the supervention of anchylosis; and whilst the constitutional condition has not advanced to hectic and emaciation.

Secondly, anchylosis of a nature inappropriate to the use of the limb; being ligamentous where osseous union is required, as in the knee; or osseous where ligamentous connection is necessary, as in the elbow.

Thirdly, anchylosis, with mal-position of the limb. In the event of *fibrous* anchylosis, with mal-position, mechanical extension of the limb, tenotomy, or both these resources may be previously tried.

Conditions of Knee-Joint Disease appropriate for Excision, with Nine Cases.—The knee-joint considered in relation to the operation of excision illustrates all the foregoing rules. But there are also certain peculiar conditions pertaining to this joint, which more especially determine the propriety of this operation.

(1.) Compared with other joints, a certain *limit to the extent* of disease is essential to success. The disease must not extend in either the femur or the tibia beyond the limits requisite for the formation of sufficiently wide-based osseous surfaces to permanently support the weight of the body, and for the preservation of a sufficient length of limb to be really useful.

(2.) In *young* subjects—under the age of about ten or twelve years—it is of importance that the disease should not extend beyond the limits necessary for the preservation of the epiphysial cartilages; the integrity of these in part, at least, being requisite for maintaining the subsequent growth of the limb in length.

Cases 1 and 3 were partly narrated in the Hospital Reports of the 'Lancet' of 1860; the history of the remaining seven cases I have drawn up from clinical notes carefully taken by Mr. T. C. Murphy, Senior House Surgeon at the Royal Free Hospital.

Case 1.—*Chronic synovitis, of traumatic origin; ulceration of the articular cartilages, and extensive caries of the ends of the femur and tibia in the knee-joint; excision. Recovery, with firm osseous union and a thoroughly useful limb in two months. Result known to be permanent after ten years.* (Plate I, fig. 1.) —ElizabethD—, æt. 33, married, without offspring, had always enjoyed good health. September 29th, 1853, she slipped down and wrenched her right knee inwards, causing severe pain, and considerable swelling ensued. Leeches and blisters were applied from time to time without any amendment. In October, 1858, a rheumatic attack apparently affected the joint.

September 12th, 1859, admitted into the Royal Free

Hospital. The joint was considerably and uniformly swollen. Three sinuses, one being in the popliteal space, discharged a thin ichorous matter; mobility of the joint with a grating crepitus plainly declared destruction of the articular cartilages, and the leg was drawn backwards towards the buttock, rendering the limb functionally useless. The constitutional condition was that of nervous exhaustion from six years' suffering, and the patient obtained snatches of sleep occasionally only by pouring a pitcherful of cold water over the knee to extinguish the pain, as she said, with the hope of dozing off before it returned; but there was no hectic nor marked emaciation.

October 19th.—Chloroform having been administered, I excised the joint. The instruments used, and which I generally prefer, were a breast-knife and a short broad-bladed saw; or Butcher's saw may sometimes be more handy. By a curved incision, extending from one condyle of the femur to the other, and passing in its course just below the articular surface of the tibia, the joint was fairly laid open. The portions of bone removed were, the articular end of the femur immediately above the condyles and the articular surface of the tibia, a central portion of the cancellated structure of the femur also being scooped out for more than an inch in extent. The patella, although healthy, was then removed. No vessel required ligature, one or two small articular branches ceasing to bleed under pressure and exposure. The leg having been extended, the healthy surfaces of bone were seen to be adjusted to each other and in easy contact; the limb was laid in a well-padded McIntyre splint of such a length as to maintain this position. The foot-piece was screwed up perpendicularly, a direction which tends to maintain the tibial surface in apposition, and the whole limb was elevated five or six inches, which further aids the same purpose. Broad strips of adhesive plaster were drawn round the limb immediately above and below the knee, and high up on the thigh, and narrow strips around the ankle and instep. A roller bandage was applied from the foot upwards, and high up from the thigh downwards, leaving the knee uncovered. Lastly, the line of

incision was closed by points of silver-wire suture, and overlaid with strips of wet lint covered with oil silk.

The general health improved rapidly after this operation. Primary union of the wound took place, except externally, where healthy granulations sprang up.

At the end of a month the splint was removed for the purpose of cleanliness, and to see that the heel, or any other point of pressure, remained sound.

At the end of eight weeks, an unusually short period after excision of the knee-joint, the splint was finally removed. So firmly had union taken place that a bandage only was applied, the limb being slung from the shoulder, and the patient allowed to move about on crutches.

The result of this case, is permanently firm union and a symmetrically-shaped limb, there being no displacement of the femur by abduction, rotation outwards, or projection of the lower end forwards. The patient walks well, unaided by the use of a stick, and provided only with a high-heeled shoe; her carriage is so easy that the effect of excision is scarcely observable, and she can walk distances of four, six, and eight miles a day. This condition has stood the test of ten years' usage.

Case 2.—*Chronic synovitis, apparently of constitutional origin; pulpy thickening of synovial membrane; ulceration of the articular cartilages, and superficial caries of the ends of the femur and tibia; excision. Recovery, with firm osseous union and a useful limb in three months.*—William A—, æt. 27, labourer, has never had any serious illness. About five years ago, swelling and trifling pain in the left knee commenced, apparently without any cause, and continued for two years. Then the knee began to stiffen, and the pain increased. Last March he underwent treatment in one of the county hospitals; the limb was placed at rest upon a splint and the joint blistered, but on leaving the hospital in June he could not put his foot to the ground, and was compelled to use crutches.

Admitted into the hospital in July, 1869. The knee was

greatly enlarged, the swelling corresponding in outline to the synovial capsule, but extending upwards anteriorly above the condyles of the femur for nearly three inches, and downwards towards the insertion of the ligamentum patellæ. This swelling had a pulpy or doughy consistence imbedding and concealing the patella and bony prominences of the joint, and projecting externally in the form of a prominent, circumscribed fluctuating tumour. The leg was drawn backwards to an angle of about 70°, the muscles of the thigh and calf were much wasted, and the limb had become quite useless. Great pain was occasioned by any attempts at extension or flexion, or by jarring the heel. Under chloroform limited motion only could be produced, and grating crepitus could be very distinctly felt in the joint. The general health remained unaffected.

July 17th.—I excised the joint by the same semi-lunar incision, removing the articular end of the femur just above the condyles, the articular surface of the tibia, and the patella. The pulpy thickened synovial membrane was also removed as much as possible. No ligatures were required. The limb was well adjusted in a McIntyre splint, and an outside interrupted splint applied.

This latter and additional security had not been used in the previous case, but I had recourse to it in the present and in subsequent cases to counteract the tendency to the threefold displacement of the femur after excision of the knee, by abduction, rotation outwards, and projection forwards of its lower end. The two first displacements give the characteristic bow-legged and twisted appearance which, in a greater or less degree, is so common in the result of knee-joint excision, and which proceeds apparently from muscular action; but the tendency to projection forwards seems to be produced by a constant sinking of the buttock in bed, whereby the lower end of the femur is tilted forwards. The side splint specially prevents or checks all three displacements.

The wound was closed with silk sutures and dressed with strips of lint soaked in carbolic lotion, one part of the

acid to forty of water, this being the first case in which I used any kind of antiseptic dressing.

In two days after the operation a slight red blush had overspread the knee, accompanied with some feverishness. This disappeared in two days more, and primary union had taken place along the line of incision except at the inner angle. All the sutures were removed, although no irritation had supervened.

In ten days the union had become firm and secure along the whole line of incision, except at the inner angle, where granulations had sprung up, leaving a small central aperture discharging.

On the seventeenth day the splints were removed, cleansed, and readjusted.

46th day.—Splints were again removed. A thick callus surrounded the ends of bone, giving to the knee an enlarged and almost globular shape. No pain on manipulation or pressure. A back splint was applied, and the limb slung, the patient began to move about on crutches.

In the course of six weeks more the union had become firmly osseous.

Case 3.—*Scrofulous caries of the ends of the femur and the tibia in the knee-joint, of traumatic origin, partial ulceration of the articular cartilages; excision. Recovery, with union in three months. Apparent recurrence of the disease, amputation, recovery.*—John P—, æt. 18, a scrofulous-looking subject, and by occupation a coal porter. About five years and a half ago a large piece of coal fell on his right knee, and occasioned pain for some days followed by considerable swelling. In three months the hamstring muscles had become so contracted as to draw the leg backwards to nearly a right angle with the femur. He underwent treatment in five metropolitan hospitals at various intervals, making a sum total of twenty-four months or two years of treatment without operative interference.

October 19, 1859, admitted into the hospital. The joint was then uniformly swollen, a thin unhealthy purulent dis-

charge issued from two or three sinuses which led into the articulation, and the leg was much retracted. Patient much emaciated. The constitutional condition in this case, therefore, was first improved by medicine and diet.

October 31st.—I excised the joint in the manner already described. The portions of bone removed were a thin slice from the articular end of both bones; and the patella, itself sound, was also removed. No ligatures were required. The limb was put up in a McIntyre apparatus. Silk sutures and water-dressing were used to close and dress the wound.

On the eighth day after operation some secondary hæmorrhage occurred, which was arrested by the application of ice.

December 17th, or six weeks after operation, the splint was removed, and partly firm union had taken place. The splint re-applied. General health much improved.

January 2nd, 1860, or at the end of two months, the union more firm, and the limb replaced on a short posterior splint.

From this time the patient sat up in bed daily, and when the weather became warmer, he took gentle exercise with the leg suspended in a sling.

Soon after, he left the hospital for the Margate Infirmary, in order to re-establish his health.

The ultimate result of this case was apparently unsuccessful.

Ten months after excision he went into St. George's Hospital, and the limb was amputated in the thigh.

The condition, constitutional and local, for which it was deemed advisable to resort to amputation, is recorded in the Catalogue of the Pathological Museum of St. George's Hospital, under the significant heading "Repair after Excision;" and this portion of the case is also reported in the 'Path. Soc. Trans.,' vol. xii, p. 171. The former source of information states that the patient was admitted into the Hospital (St. George's), August 1st, 1860, "in a state of great emaciation and weakness, with constant pain and discharge from

numerous sinuses around the situation of the joint." On the other hand, examination of the bones after amputation showed that a considerable amount of osseous union had already taken place anteriorly, "firmly soldering the ends of bone together," and that "ossification was here progressing in various parts." It may therefore, I think, be fairly inferred that the bone continuous with the seat of this progressive reparation could not have lost its vitality, and that time only was necessary to have completely overcome any apparent tendency to carious destruction. Duly weighing the evidence on either side of the question, as to the necessity for removing the limb, I cannot accept this case as an indisputable instance of unavoidable secondary amputation after excision of the knee-joint. At the same time, I am happy to add that the amputation was followed by a "rapid recovery."

Case 4.—*Scrofulous caries of the ends of the femur and the tibia, of traumatic origin, ulceration of the articular cartilages; excision. Recovery, with partly firm union, in three months. Formation of abscesses and sinuses around the callus, and prolonged discharge. Amputation and recovery in a month.*—Emily R—, æt. 20, unmarried. Her father and two brothers died of phthisis. Between twelve and fifteen years ago she had enlarged and painful glands in the neck. About one year ago she first noticed a slight pain occasionally in her left knee. In two or three months swelling commenced. About six months subsequently she slipped on a wet floor, and the knee struck the board violently. The pain and swelling increased, followed by retraction of the leg to a semiflexed position.

April, 1869, admitted into the hospital. The knee presented an uniform globular enlargement, measuring 15⅜ inches in circumference at the widest part, This swelling was of soft consistence, but without fluctuation at any part, and of an uniformly white colour, mottled on its inner aspect with dilated veins. There was considerable tenderness on pressure over the patella, and any attempt at move-

ment caused extreme pain. The leg had become retracted nearly to the nates, and the thigh much flexed on the trunk, the knee being drawn up nearly to the chin, and appearing just under the bedclothes. Both the thigh and calf were much wasted. The lungs and other internal organs seemed healthy on physical examination. The patient's general health was much impaired, especially in regard to digestion; a capricious appetite, brownish furred tongue, and irregular bowels, being the habitual state; attacks of sickness and constipation followed by diarrhœa occurring not unfrequently. But no hectic nor any marked emaciation had supervened, for no discharge had commenced; the patient slept well and was cheerful. She had been under treatment for nine months as an out-patient at a county hospital and at a dispensary.

April 24th.—I excised the knee-joint, removing the articular end of the femur just above the condyles, and a slice from the head of the tibia; also the patella. The sections showed healthy bone, two arterial branches in the osseous surfaces spouting freely. No ligatures were required. The limb was firmly fixed in a McIntyre splint, with a long interrupted outside splint and spica bandage. The wound, closed with silk sutures, was dressed with strips of lint soaked in carbolic acid lotion.

After the operation, the principal events of importance were these:—distressing retching and sickness, arising apparently from the influence of chloroform, which continued for a week, and nearly proved fatal from exhaustion. Unrelieved by ice internally, hydrocyanic acid, creosote, or by a blister to the epigastric region, this gastric irritability subsided under the hypodermic injection of morphia, in doses of $\frac{1}{6}$ of a grain increased to a grain, while life was sustained by nutritive enemata. The wound remained inert during this week of sickness; then, on the seventh day, it began to heal by primary union partly and by granulation, along the line of incision, leaving the angles open.

The apparatus was removed and reapplied on the 21st day, 36th, 55th, 78th, and 96th day. A drainage tube introduced on

the fourth occasion was now withdrawn, as all discharge had nearly ceased. On the 96th day, or three months after the operation, partly firm union had taken place, but the patient could not raise and support the limb horizontally. A short straight back splint having been applied, she was carried down stairs into the open air daily. Her general health had much improved.

The remaining course of this case comprised the subsequent formation of abscesses and sinuses around the callus, prolonged discharge, and declining health.

December 18th, or 240th day after the operation of excision, I attempted re-excision. But the ends of the femur and tibia were found to be soft and spongy, and ununited posteriorly, where also an abscess extended some distance up the thigh. Accordingly, *amputation* was immediately resorted to in the thigh, at the juncture of its middle and upper third.

The patient recovered without an unfavorable symptom. On the 24th day she sat up, and continued to regain flesh and strength. She left the hospital for Bristol as soon as her health had become completely re-established, or at the end of ten months from the date of admission.

Case 5.—*Scrofulous caries* of the ends of the femur and tibia, in the knee-joint; of *traumatic* origin; 12 *years' duration*, with occasional treatment; in a young woman, aged 18. *Ulceration of the articular cartilages. Excision. Secondary hæmorrhage* next day, suppressed by ice-bag. Displacement and projection of the end of the femur on the 5th day. *Re-excision* of its extremity. *Albuminous urine* supervened in a few days, with marked cachexia and prostration; and sloughing of the integument of the calf. *Amputation* in middle third of the thigh. Rapid disappearance of albumen in the urine, and restoration of strength. *Recovery* by primary union, with a perfectly sound stump in one month.

About six months afterwards, stump still sound, but the patient was affected with scrofulous conjunctivitis and opacity of the cornea; also complete deafness.

Case 6.—*Scrofulous caries of the ends of the femur and the tibia, especially the latter, in the knee-joint of a child; of supposed traumatic origin; ulceration of the articular cartilages; excision through the epiphyses. Recovery, with firm osseous union and a useful limb in four months.*—Elizabeth A. G—, æt. 5, an apparently healthy child. About three years and a half ago, slight pain and swelling commenced in the left knee. There is no history of direct injury, but the child fell out of bed on several occasions previous to the symptoms of knee affection; and subsequently she used to expose the joint to cold air and the contact of cold substances for relief from pain. In six weeks after the first symptoms an abscess formed in the inner side of the head of the tibia; it soon broke, leaving a discharging aperture, and the leg gradually became bent backwards.

July, 1869.—Admitted into the hospital. The knee presents the characteristic globular enlargement of firm consistence, with the small discharging aperture referred to, and which led to carious bone. The leg is retracted so that only the toes touch the ground. General health good.

24th.—I excised the knee-joint, in this case making a section of the epiphysis in the condyles of the femur and in the head of the tibia, both of which were undergoing ossification. But a portion of carious bone about one inch in depth was gouged out of the inner half of the head of the tibia. No ligatures were used, the limb was carefully adjusted, and the wound dressed as in the previous cases.

Primary union took place along the line of incision, except, as usual, at the angles. The splints were removed and re-applied at the end of three weeks and five weeks. On the latter occasion union had become consolidated sufficiently to allow only slight antero-posterior motion. She could slightly raise the limb from the bed. Union subsequently became firmly osseous at the end of four months.

The three following cases illustrate excision of the knee-joint for a functionally useless limb, resulting from failures of the natural cure, whether in regard to the

kind of anchylosis or as conjoined with malposition of the limb.

Case 7.—*Chronic synovitis* of traumatic origin, one year's duration, ten months' treatment, in a young man, H. G—, æt. 20. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous anchylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Useless tenotomy* of the hamstring muscles; *excision. Recovery,* with a thoroughly firm *osseous union* and useful limb in two months and a half. (Plate II, fig. 1.)

Case 8.—*Scrofulous caries* of traumatic origin, fourteen years' duration, with occasional treatment, in a youth, H—, æt. 17. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous anchylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Useless tenotomy* of the hamstring muscles; *excision. Recovery,* with *osseous union* and a useful limb in two months. This patient sat up out of bed daily at the end of five weeks. (Plate II, fig. 2.)

Case 9.—*Scrofulous caries* of traumatic origin, seven years' duration and equally prolonged treatment, latterly by *extension* of the limb, in a boy, T. W—, æt. 10. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous anchylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Excision through the epiphyses. Recovery,* with *osseous union* and a useful limb in two months and a half. (Plate I, fig. 2.)

The following facts respecting the foregoing cases of knee-joint disease and excision seem specially worthy of notice :—

(1.) *Conditions of disease.*—Caries in all cases, with destruction of the articular cartilages of both the femur and tibia. In case 1 the femur was chiefly affected, in case 6 the tibia, and in the other 7 cases both bones were about equally affected. The patella was healthy in nearly all cases.

(2.) *Commencement of the disease.*—Synovitis in 3 cases, 1, 2, and 7; scrofulous caries in the other 6 cases.

Cause.—Traumatic in 8 cases, constitutional in case 2.

(3.) *Duration of disease and of treatment previous to operation.*—Case 1, disease 6 years, treatment occasionally. Case 2, disease 5 years, 4 months' treatment. Case 3, disease 5½ years, 2 years' treatment. Case 4, disease 1 year, 9 months' treatment. Case 5, disease 12 years, occasional treatment. Case 6, disease 3½ years, occasional treatment. Case 7, disease 1 year, 10 months' treatment. Case 8, disease 14 years, treatment occasionally. Case 9, disease 7 years, and equally prolonged treatment.

(4.) The constitutional disorder had *not* advanced to hectic and emaciation in any of the 9 cases except in case 3. In case 1, nervous exhaustion; 2, health good; 4, health irregular, digestion impaired; 5, marked anæmia; 6, health good; 7, health good; 8, health good; 9, health delicate with constant cough.

(5.) *Age and sex.*—Age; 33, 27, 18, 20, 18, 5, 20, 17, and 10 years. Sex; five males and four females.

(6.) *Operation.*—The *incision* was semilunar downwards from condyle to condyle in all the cases. The *portions of bone* excised were the articular ends of the femur and tibia in all the cases, with additional portions of cancellated bone in cases 1 and 6. The patella was removed in all cases. The *synovial membrane* was also removed as much as possible in cases 2 and 7 of chronic synovitis. *Hæmorrhage* was inconsiderable during the operation in all the cases, no ligatures were required, the articular vessels being secured by torsion and exposure. *Sutures*—metallic in case 1, silk in the subsequent 8 cases. *Dressings*—water dressing in cases 1 and 3, weak carbolic lotion in the other 7 cases. *Splints*—a McIntyre, or else a back splint with foot-piece in all the 9 cases, with an outside, interrupted splint in all cases except 1 and 3.

(7.) *Primary union.*—Complete, except just at angles of the incision, in cases 2, 6, 7, 8, and 9, or in 5 cases; partial in cases 1, 3, 4, and 5, or in 4 cases.

Secondary hæmorrhage in cases 3, 5, and 8; arrested by ice in the first case, by ligature in the latter 2.

(8.) *Intervals of removal of splints.*—Average period one month after operation and at similar periods subsequently, making only three or four reapplications of the retentive apparatus in each case.

(9.) *Results.*—Osseous or firm union in all the cases; except case 3, where it was incomplete, and in cases 4 and 5, which were subjected to amputation. Period of union, average three months.

(10.) *Re-excision* in case 5—a scrofulous case.

(11.) *Secondary amputation* in cases 4 and 5—both scrofulous cases; also in the questionable case 3—a scrofulous case.

(12.) *Permanent result.*—Ultimate known period—(1) 10 years, (2) 5 months, (6) 4 months, (7) 2 months, (9) 2 months.

Conditions of Hip-joint Disease appropriate for Excision, with six Cases.—Of the three conditions already defined with regard to the excision of joints in general, the first only applies to the hip-joint.

(1.) Functional inutility of the limb, depending on disease of the joint having resulted in destruction of the articular cartilages without the supervention of anchylosis, will always justify operative interference by excision. The constitutional condition will probably not then have advanced to hectic and emaciation. But the state of the general health should primarily determine the necessity for excision in all cases, and not any arbitrary consideration of the period of the disease and the condition of the joint. Whenever, therefore, the general health is manifestly failing, whatever may be the stage of hip-joint disease, excision should be resorted to without further delay. This guiding rule was strongly urged and clearly illustrated by Mr. Hancock in his recent lectures on diseases of the joints at the Royal College of Surgeons.

Nevertheless the most extreme state of exhaustion, previous to the operation of excision, may be followed by recovery

after removal of the diseased bone, as the successful results of cases 1, 2, and 4, clearly show.

(2.) Osseous anchylosis with mal-position of the limb will *not* justify the peril of attempted excision. Section of the neck of the femur is practicable, whereby the limb can be brought down to a straight position. This principle of operation was lately practised in a case by Mr. W. Adams, and I believe successfully. The following structural conditions of disease as pertaining to the hip-joint affect the propriety of its excision :

(3.) The *extent of bone* diseased may be considerable, and involve both the femur and acetabulum. In the *femur* the diseased portion may include the head, neck, great trochanter, and shaft, entering even into the medullary canal. In the *acetabulum* the diseased portion may include the whole floor of this cavity, and even extend to adjoining portions of the ilium, pubes, and ischium. Neither of these conditions of extensive osseous disease prohibits excision; but the acetabulum not unfrequently recovers itself when the diseased head of the femur has been removed from further contact and attrition.

(4.) Dislocation is unfavorable for excision, as implying an advanced stage of the disease constitutionally. The significance of this local condition will, therefore, diminish in proportion to the absence of marked hectic and emaciation.

The clinical notes of the following cases were carefully taken, in the first two by Mr. John B. Foster, and the latter two by Mr. Marriott, then House Surgeons at the Royal Free Hospital. From these sources I have drawn up the histories as follows :—

Case 1.—*Scrofulous caries of the femur ; the head and the articular cartilage entirely destroyed, the neck, great trochanter, and one inch of shaft involved, with one inch more of cancellated structure ; similar disease of acetabulum, and horizontal ramus of pubes ; dislocation on dorsum ilii with abscess ; disease of traumatic origin ; excision of four inches of femur, and*

one inch of cancellated structure. Recovery, with a freely movable joint and a useful limb, in three months. Result known to be permanent after two years and a half.—William M—, æt. 26, a sailor. Four years ago, on board ship, he fell from the mast, thirty feet, and pitched on his left hip. Severe pain and swelling ensued, which were relieved by cupping; but the pain became paroxysmal, sometimes being very severe, and lasting for days or weeks with interperiods of perfect ease. One year after the accident, an abscess broke over the great trochanter, and ten other sinus openings subsequently formed around the joint. Shortening of the limb commenced, apparently when the abscess broke, and it gradually became shorter. From that date the patient went into the Dover Hospital, where he remained for nearly three years.

March 28th, 1864, admitted into the Royal Free Hospital. The limb was then three inches shorter than the sound one, and much inverted, the left knee resting on the opposite thigh. Dislocation backwards on the dorsum ilii had taken place, and there was great obliquity of the pelvis. With considerable wasting of the muscles of the limb, the upper third of the thigh was much enlarged, and presented twelve openings in the neighbourhood of the joint, two of them being over the ramus of the pubes. All of them led down to diseased bone. The patient was pale and thin, had scarcely any appetite, and a bad cough. I therefore placed him under a course of tonic treatment, iron and quinine, with a nourishing diet, in order to revive, as much as possible, the power of assimilation and reparation, necessary for the long process of recovery after the operation of excision.

May 7th.—I excised the hip-joint. The principal features of the operation in this and subsequent cases were these:—A longitudinal incision on the outer side of the shaft of the femur, to the extent of three or four inches, and terminating a little above the great trochanter, was met by a slight transverse incision in that situation. The muscles attached to the latter portion of bone were severed by sinking the knife vertically in the transverse cut; the crural nerve and artery anteriorly, and the sciatic nerve and gluteal artery

posteriorly, being necessarily avoided by the limited extent of this incision. The finger was then passed down above the trochanter along the neck to the joint; or in the present case and others, to the head of the femur on the dorsum ilii, dislocation backwards having taken place. In any further detachment of the soft parts the knife was simply directed towards and on the bone. Adduction and eversion of the limb will readily make the head of the femur start from the acetabulum, or from its bed on the dorsum ilii. Sometimes, in making eversion the capsular ligament may have to be opened, and the round ligament just touched with the knife on the head of the femur; generally, both ligaments are destroyed, and the acetabulum has become so patulous, that the head of the bone, itself a remnant, can be readily turned outwards into position for application of the saw. The whole diseased portion, including perhaps the neck, great trochanter, and portion of the shaft, may be removed, either at once or by successive sections, until healthy bone is reached. Lastly, the acetabulum may have to be gouged, and perhaps adjoining portions of bone.

In the present case the femoral portion of bone was alone excised, but to the extent of four inches; and carious cancellated structure of the shaft was scooped out for about an inch, entering the medullary canal, and leaving a mere shell of hard bone, with, however, the periosteum and the soft parts attached. No ligatures were required. The wound was closed with silk sutures, and water-dressing applied. No splint was used, the limb being left to take the easiest position, so that the end of the femur hitched upon the dorsum ilii just above the acetabulum.

Excepting excessive sickness from the chloroform, the patient's health improved rapidly, and he recovered without an unfavorable symptom.

Healing by granulation took place, owing apparently to the length and depth of the wound necessary for the excision of so large a portion of bone.

June 4th, or about one month after operation, the granulation process had advanced to the surface.

July 27th, or seven weeks more, and about three months after the operation, the wound had nearly closed. Moving the limb occasioned no inconvenience, and the patient was allowed to get about on crutches. He had become quite fat; his jaded and cachectic appearance was converted into a ruddy complexion, with bright eyes, and a cheerful or rather boisterous manner; and he himself said that "William is a man again."

Known permanent result at the end of two years and a half; he walked without any support.

Case 2.—*Caries of femur; its neck and great trochanter, the head involved, with circumferential destruction of the articular cartilage, and disease in the shaft to two inches in extent, with one inch more of cancellated structure; similar disease of acetabulum; dislocation on dorsum ilii with abscess; immediate cause, cold; excision of four inches and a half of femur, and the one inch of cancellated structure. Recovery, with a freely movable joint, and a useful limb, in two months and a half. Result known to be permanent after five years.*—J. R—, æt. 16, dairyman at Sutton-Bingham, Somersetshire. About one year ago, having caught a severe cold, he felt a slight pain in his hip, which gradually increased and extended down the thigh to the knee-joint. Afterwards he had an attack of rheumatic fever. An abscess formed over the hip; this was opened, it continued to discharge, and the limb began to shorten.

July 22nd, 1863, admitted into the hospital. There was then the same characteristic appearance of advanced hip-joint disease as in the last case; shortening of the limb to the extent of two inches and a half, inversion, the knee resting on the middle of the opposite thigh, and dislocation backwards on the dorsum ilii. Over and about the great trochanter were three sinus openings leading down to diseased bone, and discharging copiously day by day. The boy looked haggard, and was worn down to a shadow.

Considering the extremely unfavorable constitutional condition in this case, excision was resorted to with the view of

saving *life*, and possibly of preserving a sound if not an eventually serviceable limb.

August 16th.—Operation performed; four inches and a half of the femur were removed, and one inch of cancellated structure was scooped out from the lower end of the section in the shaft. No ligatures were required, and no splint applied at the time of operation.

Primary union of the wound ensued in this case.

After the first three days the boy's health took a favorable turn, and steadily improved.

In two weeks a long external splint was applied.

In ten weeks the limb could be moved freely in all directions without pain, the patient beginning to use it only on crutches. From being a miserable object he had become healthy and fat.

In 1868, or five years after the operation, he could walk without support.

Case 3.—*Caries of femur; its head and neck entirely destroyed; great trochanter and a small piece of the shaft involved; similar disease of acetabulum; dislocation and abscess on dorsum ilii; disease of traumatic origin; excision of one inch and three quarters of femur. Recovery, with a freely movable joint and a useful limb, in three months.*—G. C—, a male child, æt. 5. Two years ago he was run over, a wheel passing over the right hip. The course of this case, in respect to the joint and limb and their eventual appearance, were precisely the same as in the previous cases.

June 9th, 1864, admitted into the hospital. Dislocation on the dorsum ilii had taken place, and shortening of the limb to the extent of three inches. In October the abscess burst externally, and from that time matter was discharged freely from two sinuses in the upper part of the thigh, both of which led down to the joint. The child's general health had always been good.

November 12th.—I performed the operation precisely as in the previous cases, and the after-treatment was also the same. The result equally successful.

Case 4.—*Caries of femur, its head and neck destroyed; similar disease of acetabulum; immediate cause, cold; excision of two inches of femur. Recovery, with a movable joint and useful limb, in two months.*—E. M—, a boy, æt. 8. Five years ago he took cold by sitting on stone pavement, and inflammation of his left hip-joint began. About eighteen months since an abscess broke, and discharged considerably and permanently through a fistulous opening. Other sinuses followed.

June 10th, 1864, admitted into the hospital. The thigh was turned inwards, forming an acute angle with the abdomen, with slight shortening of the limb, but no dislocation had taken place. Suppurative discharge, long continued, had induced emaciation almost to the degree of advanced phthisis; the child was haggard and spiritless, his expression and manner deliberate like that of a little old man, and he was altogether the picture of premature age.

Having due regard to this extreme state of constitutional exhaustion, I placed the patient under a restorative course of treatment, as in case 1, but in this case continued for seven weeks.

August 1st.—I excised the hip-joint as in the other cases, and with the same after-treatment. Primary union ensued, except in one spot, which gradually closed. The child rapidly regained flesh, yet he remained blanched and pain struck in appearance.

In two months the new joint and the limb were movable and useful, a crutch being used for support.

Case 5.—Jane L—, *caries* of femur, its head and neck destroyed; similar disease of acetabulum, of traumatic origin; *3 years' duration, 2½ years' treatment;* in a female child æt. 5. *Excision* below great trochanter. *Recovery,* with a movable joint and useful limb, in 4 months. *Result known to be permanent after* 3 years.

Case 6.—Catherine R—, *scrofulous caries* of femur, its head and neck destroyed; similar disease of acetabulum;

dislocation and *abscess* on dorsum ilii; disease apparently of traumatic origin; 1 *year and* 8 *months' duration and treatment;* in a female child æt. 5. *Excision* below great trochanter. *Recovery,* with a movable joint and useful limb, in 3 months.

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, at that time Senior House-Surgeon in the hospital.

The following facts respecting the foregoing cases of hip-joint disease and excision seem specially worthy of notice.

(1.) *Conditions of disease.*—Caries in all cases, with destruction of the femoral articular cartilage, entirely in 1, 3, 4, 5, 6, or in five cases; circumferentially only in case 2. Extent of bone diseased was the head and neck in each case; with the great trochanter and portion of the shaft in cases 1, 2, 3; and an extra portion of cancellated structure of the shaft in cases 1 and 2; caries of the acetabulum to some extent in all cases, and of ramus of pubes in case 1; dislocation on dorsum ilii in cases 1, 2, 3, 6; or in 4 out of the 6 cases.

(2.) *Immediate cause.*—Injury in cases 1, 3, 5, 6; cold in 2, 4.

(3.) *Constitutional condition.*—Advanced hectic in cases 1, 2, 4, 6, or in 4 of the 6 cases; health good in cases 3 and 5.

(4.) *Previous duration of disease*—4 years, 1 year, 2 years, 5 years, 3 years, 1 year and 8 months. *Previous duration of treatment.*—Case 1, 3 years; case 5, 2½ years; case 6, 1 year and 8 months.

(5.) *Age and sex.*—Age; 26, 16, 5, 8, 5, 5 years. Sex; 4 males and 2 females.

(6.) *Operation.—Incision* T-shaped in all cases, *Portions of bone* excised: (1) Four inches of femur, and one inch of cancellated structure scooped out; (2) Four inches and a half of femur, and one inch of cancellated structure scooped out. In both these cases the medullary canal was entered; (3) One inch and three quarters of femur; (4) Two inches of femur; (5) Section just below great trochanter; (6)

Section just below great trochanter. Small portions of the acetabulum were scooped out in each case. *Hæmorrhage* inconsiderable in all the cases. No ligatures required. Silk sutures and water-dressing applied in all the cases. *No splint* was used in any of the cases, the section of the femur being left free to form a fibrous anchylosis.

(7.) Primary union ensued in all the cases, except the first, wherein the wound healed by granulation.

(8.) *Results.*—Firm fibrous anchylosis, with a movable joint and useful limb in all the cases.

(9.) Result known to be permanent in case 1, after $2\frac{1}{2}$ years, in case 2, after 5 years, in case 5, after 3 years.

Conditions of Elbow-joint Disease appropriate for Excision, with Five Cases.—The three conditions which severally determine the propriety of excision with regard to the joints in general, are applicable to the elbow-joint.

(1.) Functional inutility of the limb, depending on disease of the joint having resulted in destruction of the articular cartilages, without the supervention of anchylosis, will always justify excision; care being taken that the constitutional condition shall not, if possible, have approached to exhaustion. But the degree of reserve power requisite for recovery is much less than after excision of the knee or hip, owing to the average period of reparation being less by one half, or about six weeks instead of three months.

(2.) Osseous anchylosis, and particularly in connection with a useless position of the limb, will also justify excision.

(3.) The structural conditions of disease pertaining to the elbow-joint, which specially affect the propriety of its excision, relate to the *extent of bone* destroyed by disease. The limits of excision of the elbow-joint are not restricted by two of the three considerations respecting the knee-joint. Thus, the length of the portions of bone removed from the elbow is comparatively unimportant; the corresponding loss of length in the arm not much impairing the use of this member eventually; nor is it of consequence, therefore, to observe the epiphyseal lines as affecting the subsequent growth of the

bones. But it is equally requisite in the elbow as in the knee to preserve sufficiently wide surfaces for the formation of an adequately secure union; in the one case, with ligamentous mobility; in the other, with osseous consolidation.

The removal of only a thin superficial section of the articular ends of the bones in the elbow-joint, leaving the section ends too nearly in contact, is apt to be followed by osseous union and an unsuccessful result of the operation. On the other hand, any new bone which may not unfrequently have been produced in the form of a spiculated enlargement of the articular ends *above* their diseased portions, and thereby limiting the disease, should not be included in the excision. The importance of observing this limitation of the operation is particularly urged by Mr. Butcher in his work on 'Operative and Conservative Surgery.'

The notes of the following cases, excepting the first, were taken by Mr. T. C. Murphy, Senior House Surgeon at the Royal Free Hospital.

Case 1.—Margaret R—, *chronic synovitis*, of traumatic origin, 1½ year's duration, 1 year and 2 months' treatment; in a woman æt. 25. *Partial ulceration* of the articular cartilages of the humerus, ulna and radius; with semiflexed position of the limb. *Excision. Recovery*, with a movable joint and useful limb, in six weeks. *Result known to be permanent after 7* years.

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, then Senior House-Surgeon in the hospital.

Case 2.—Thomas H. B—, *chronic synovitis* of traumatic origin, 1 year's duration and treatment, in a man æt. 29. *Ulceration* of the *articular cartilages* of the humerus, ulna and radius; with semiflexed position of the limb. *Excision. Recovery*, with a partially movable joint. Subsequent formation of abscess and sinuses. *Re-excision. Recovery*, with a movable joint and a limb useful, in flexion, extension,

pronation and supination. *Result known to be permanent after* 1 year and 4 months.

Case 3.—Mary M—, *acute synovitis* of traumatic origin, one month's duration, in a woman æt. 28. *Partial ulceration* of the *articular cartilages* of the humerus, ulna and radius, with subjacent *caries;* a semiflexed position of the limb; *excessive* and *paroxysmal pain. Excision. Recovery,* with a movable joint by passive motion, in six weeks. *Result known to be permanent after* 1 year.

Case 4.—Jane T—, *scrofulous caries* of the ends of the humerus and ulna in the elbow-joint of a very weakly woman æt. 31. *Ulceration* of the *articular cartilages,* with semiflexed position of the limb. *Excision. Recovery,* with a partially movable joint by passive motion, in two months. *Permanent* result, at the end of six months, uncertain.

Case 5.—Locus P—, *caries* of the olecranon, of idiopathic origin, ten months' duration and treatment; idiopathic abscess opposite the outer condyle of the humerus, six years previously; in a man æt. 50.

Carious bone gouged out of the olecranon. The joint opened in this procedure. *Excision* of the olecranon and of the end of humerus, in order to form a freely movable joint by fibrous anchylosis. Wound nearly healed by primary union. Fibrous anchylosis progressing.

The following *general results* of excision and their relation to conditions of disease of the joints, as illustrated by the foregoing cases, may be noted in conclusion:

1. *Excision* proved successful by one operation, in 16 out of 20 cases of the knee, hip, and elbow-joints.

2. Of the 4 unsuccessful cases by one operation, 3 were cases of *scrofulous* disease, and of the knee-joint in a total of 9 cases; the remaining 1 being chronic synovitis, and of the elbow-joint in a total of 5 cases.

3. *Re-excision* was resorted to in 2 of the 4 cases; 1 knee-joint, and 1 elbow-joint, the latter with a successful result.

4. *Secondary amputation* in 3 of the 4 cases. All 3 were knee-joint cases, and subjects of scrofulous disease; 1 had been subjected to re-excision. The 3 amputations made *rapid recoveries*. These results tend to show that if the attempt to preserve a limb by previous excision, and even by re-excision of a large joint as the knee, should fail, the operation is not prejudicial to secondary amputation for the preservation of life.

5. *No death* ensued in any of the 20 cases of the knee, hip, or elbow-joints, whatever had been the condition of disease, subject to the principles of selection laid down; or whatever the operation; excision, re-excision, or secondary amputation.

DESCRIPTION OF PLATES I & II.

Plate I.

(*From photographs.*)

Fig. 1.—Case 1. Elizabeth D—. Chronic synovitis of traumatic origin, ulceration of the articular cartilages, and caries of the ends of the femur and tibia in the knee-joint. Result known to be permanent after ten years. (See page 102.)

Fig. 2.—Case 9. T. W—, aged 10. Scrofulous caries of traumatic origin. (See page 112.)

Plate II.

(*From photographs.*)

Fig. 1.—Case 7. H. G—, aged 20. Chronic synovitis; excision; firm osseous union and useful limb in two months and a half. (See page 112.)

Fig. 2.—Case 8. H—, aged 17. Scrofulous caries of traumatic origin; excision; osseous union and a useful limb at the end of five weeks. (See page 112.)

Fig 1.

Fig 2

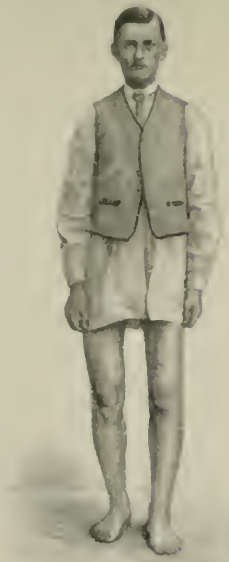

Fig 1

Fig 2

G H Ford

W West imp

AN ANALYSIS

OF

ONE HUNDRED AND EIGHTY-FOUR CASES

OF

STONE IN THE BLADDER OF THE ADULT

TREATED BY

LITHOTRITY.

BY

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Received April 12th.—Read May 10th, 1870.

During the thirty or forty years which have elapsed since lithotrity first claimed to be recognised as a surgical operation, more or less applicable to a large number of cases of extreme importance, occasional attempts have been made to determine with precision the results derived from its employment. At first sight this object might be thought easily attainable, since it would seem necessary only to compare a sufficiently large number of cases so treated with a similar number of cases by the single pre-existing operation, that of lithotomy. The capabilities of that method

were well known or might be obtained without difficulty. The cutting operation had been applied under all circumstances, and to all cases, to young and old, to stones of all sizes, small and large; and the effect of it in any case could never be doubtful.

With lithotrity, however, it was soon found to be a much less easy matter to arrive at an accurate appreciation of the results. After a few years of trial it was quite obvious that the crushing method was even more hazardous than cutting, for large stones; and for a few stones of particularly hard structure, it was impracticable. For a great majority of the cases of infants and children, it was certainly less successful than lithotomy. It was applicable then only to a certain proportion of adult cases; and did not include among them the most formidable. On this ground alone the comparison between its capabilities and those of the old method could not be easy. One thing was clear, namely, that as it was only applicable to what might be called to some extent, selected cases; its results for these ought to be very successful, or lithotomy ought not to be set aside for it. At the same time, it was not to be forgotten, that although lithotrity necessarily demands, as a condition of successful performance, a stone of not too large a size, it does not necessarily demand youth or strength of constitution, that it makes no insuperable difficulty of any age, nor a serious objection to whatever feebleness of body great age involves, provided only that the first condition exists, viz., that the stone shall be small.

An absolute comparison of results, therefore, is difficult. Lithotrity cannot be judged in this matter, unless the ages of the patients and the size of the stones dealt with, are accurately known. For it is obvious that if the lithotrity of one surgeon embraces only stones of three drachms in weight, while that of another surgeon deals with all that occur, up to five or six drachms or more, the operation of the latter will in the aggregate be a more hazardous proceeding, and will be attended with more numerous and graver casualties than the former. After much consideration of the question, I

confess it appears to me that owing to these and other circumstances, an accurate and careful appreciation of the results of lithotrity has not hitherto been made. That, perhaps, which most approaches to it is the valuable paper contributed by the late Sir B. Brodie to the Transactions of this Society, fifteen years ago, one which excited great interest at the time. To those who heard it then, or may have studied it since, it must be evident that the author made no endeavour to establish a case either for or against lithotrity. He recorded all the casualties and made no attempt to lessen their importance, or in any manner to explain away their relation to the operation. On the other hand the number and the ages of the patients, the size of the calculi, and other important particulars were not supplied.

And in regarding this record of Sir B. Brodie's experience as nevertheless one of the best existing contributions to a real knowledge of the value of lithotrity, I do not overlook the fact that during the last few years the late M. Civiale has published annual reports of his practice, giving the number of patients, and in part the results of his operations. These reports, however, never at any time contained the particulars which are essential in order to enable others to form a judgment, and which I have felt it a duty to furnish in the table of cases now presented.

It was impossible to know that accomplished operator without feeling that his natural bias for an operation he had mainly designed, was the first to perform, and with which he has been so intimately identified during life, led him, as is universally confessed, to estimate his results more favorably than an unbiassed looker on could venture to do. In short, he barely admitted that lithotrity could occasion death. It is useless to deny this fact, nor that it influences all his writings on the subject. He invariably attributed death, when it occurred in the course of or after a case of lithotrity, to some other cause, never to the operation. Such was without doubt his conscientious belief, and practically for him, although he never quite said as much, lithotrity was never fatal. But the mode of reasoning he employed would

render almost every operation in surgery innocent of fatal results. To Civiale I desire on every ground, public and private, to render due homage. It is no small boon that his skill and indomitable perseverance have conferred on suffering humanity. But the mode of estimating the results of an operation which he adopted in relation to lithotrity is not one which is, or can be, accepted here. As long as it is an accepted formulary that death may be produced by a surgical operation, and that the liability to cause death is a quality which can be approximatively estimated by observation, and the knowledge of which enables us to speak of an operation as more or less grave according to the amount of such liability proved to exist, we cannot make an exception of lithotrity.

Lithotrity does not less surely destroy life in certain cases, although no palpable lesion may be produced, than lithotomy does when the necessary wound proves fatal. The catastrophe is only much more obvious in the one case than in the other.

With this conviction I have, therefore, made it my object to test as carefully and impartially as it is in my power, the operation of crushing the stone as applied to all cases up to a certain weight, with regard to its after results, immediate and remote, the main objects of inquiry being the number per cent. of recoveries after the operation; the proportion of cases in which the stone recurs; and the condition of the recovered patient in after life; the last being from the nature of things a less easy inquiry.

With these prefatory remarks I may state that in August, 1867, I presented to a meeting of the British Medical Association in Dublin, an analysis of 100 cases of stone in the bladder, 84 of which were operations by lithotrity. Since that time I have operated, not reckoning lithotomy, on another 100 cases by lithotrity, making a total of 184 cases, occurring consecutively in my practice, not one having been omitted. All have been performed within about the last six years, at the commencement of which term I began to employ my present instruments, and had developed my

present method, and by these all have been treated. They are, therefore, well adapted to be regarded as one group with reference to the question of results.[1] The object of this paper is to offer a brief *résumé* of the facts presented by these cases, as well as of those inferences which this large number of clinical histories, carefully watched and recorded, enable me to draw.

Of every case I possess full written notes made at the time, as well as the stone itself (with a very few exceptions), carefully preserved and labelled for reference.

I adhere to my original system of verifying each one, by naming some gentleman who has seen it with me, a system unnecessary, I am quite ready to believe, for my contemporaries, but which will prove a guarantee of accuracy to unknown or future observers and commentators. The whole of the cases are placed in an appendix at the end of this paper.

In offering an analysis of these 184 consecutive cases of lithotrity, I must first state that the 100 fresh cases now published for the first time, like those which preceded them, were all adults and for the most part of an advanced age. It is still necessary to call attention to this fact, in comparing statistics relative to the operations of lithotomy and lithotrity, and to remind the reader that all numerical tables are worthless which do not separate the cases of children from those of adults, so different are the results of operations, especially by the knife, which occur above and below puberty respectively. Next, I must state that almost all these cases are those of distinct individuals. Only thirteen cases are recorded twice. The relapses, a subject which we shall consider hereafter, were few, and when a *third* operation has been necessary in one individual's life time, which has occasionally, though rarely happened, I have not noted it, making a rule that no patient should appear more than twice in the list. Otherwise, "cases" might be unduly multiplied;

[1] See a "*postscriptum*" at the end of the paper, in which it will be observed that the number of cases has been increased from 184 to 195, the deaths remaining as before.

as, for example, were operators disposed to register every occasion on which some calculous matter is removed from those patients who are constantly or frequently forming it.

Thus, in the paper by Sir B. Brodie already referred to, 115 cases of lithotrity were recorded. But Sir B. Brodie frankly states that eight of these occurred in the person of one individual, in the course of as many years, and that other cases of a similar kind were included,* so that the 115 cases might by no means represent even, or more than, a hundred individuals, while in Civiale's cases we are left altogether uninformed as to the number of individuals. In the present list the 184 cases occurred in 171 individuals.

Lastly, it must be remembered that the expectation of life, and the general quality, as regards health, of these patients is a little below the average, since it includes so many of those old and confirmed cases which seek the aid of a well-known operator as a forlorn hope, and are attracted for this purpose from every part of the world. Most of these patients are from different parts of Great Britain; but the table includes also patients from France, Germany, Turkey, Russia, Canada, Belgium, the United States, California, the East Indies, and New Zealand.

In commencing this analysis it is necessary to bear in mind certain important facts relative to age. They may be briefly stated as follows:

The mean age of the 184 cases is rather more than 61 years.

The youngest patient was 22 years old, only 3 were below 30 years, the eldest was 84 years. There were 46 cases of 70 years of age and upwards; *no less than* 113 *of the* 184 *were* 60 *years and upwards.* Next, with regard to that important point the size and weight of the stone, I may say that I have, as a rule, to which very few exceptions have occurred, applied

[1] Vol. xxxviii, p. 185.

lithotrity to every case of stone under my care, which has been obviously beneath an ounce in weight, a matter easy to determine in sounding. At one ounce and upwards I have preferred lithotomy. I may say, for the sake of giving a criterion as to size, that a uric-acid stone which weighs an ounce equals in size a large date. I know no better comparison.

In examining the results of the operation in these cases I shall inquire—first, what is the rate per cent. of recovery after the operation? secondly, what is the general condition of the patient after it? and thirdly, in how many instances is there a return of the malady?

In considering the first subject, viz. the number of recoveries per cent. which took place, I must request attention to the following statements, which are extremely important in relation to the question:

First, that I have never in my life found it necessary or desirable to complete by the knife a case of stone in which I have commenced the operation by crushing.[1] This has not

[1] I once removed a considerable phosphatic crust from an oxalate of lime stone, and so diminished its size previously to performing lithotomy; that is the only case which might have the semblance of an exception to the rule, although it is not so in reality.

The only other case in which I ever performed lithotomy and lithotrity on the same patient is that of No. 135. It might at first sight be supposed to furnish a single exception to the statement made above, but it certainly is not so.

I crushed at six sittings for a gentleman several small uric-acid calculi during October, 1868, and the first week of November. In the middle of November he left for the country to recruit his strength, and there, after exposure to cold and wet in exercise, in inclement weather, he had severe cystitis, followed by orchitis, and by a series of abscesses in the scrotum and the abdominal walls, lasting more or less until April, 1870. He then had retention of urine from deep perineal abscess, and a catheter was tied in for some days. His distress was then so severe that it was decided to have an examination under chloroform, and if anything were discovered, to perform lithotomy. I performed the operation on the 21st, Sir William Fergusson holding the staff, Mr. Pollock, Mr. Marshall, Mr. Hutchinson, and others being present. At the first incision a half pint of matter issued; quickly dividing a large prostate, I

unfrequently been done, especially in Paris, when the patient's life has been in danger; and in such circumstances, if death has occurred, it has not been placed to the account of lithotrity.

Secondly, that I have not left incomplete or unfinished a single case of stone on which the operation of crushing has once been commenced; a plan which has been pursued, also in Paris, when great difficulty or danger has arisen. The result of sending a patient into the country in these circumstances can very rarely be otherwise than hazardous or fatal. But when death has so taken place abroad it appears likewise not to have been placed to the account of lithotrity. It may, perhaps, surprise some to be told that in Paris it has been the custom to send away as uncompleted cases, or to refuse any operative aid to, a considerable proportion of the stone patients who apply for relief. This is a proceeding wholly unknown to English surgeons, and one which must receive no little weight in dealing with the results of the operations under consideration.

Thirdly, I have never refused to operate on any case of stone by one means or the other; and I have sometimes consented, rather than refuse the patient all chance of life, to perform lithotrity, when he has absolutely refused my advice that lithotomy would be for him the better operation. I am certain that two or three of the fatal cases in my table occurred in individuals for whom, had I not been fettered by circumstances, lithotomy would have been the preferable proceeding.

Certainly, as a rule, the surgeon must decline to perform any operation but that which appears to him the better of

removed two small uric-acid calculi, not coated with phosphatic matter, and quite probably of recent formation; they were not fragments, but small entire calculi, and may have been present, or not, during the period of lithotrity; on this point there is no evidence. The long period of five months had intervened between the lithotrity and the lithotomy, so that I cannot regard this as necessarily a failure in lithotrity finished by lithotomy. The patient is at this moment, July, 1870, enjoying excellent health.

two courses; but in rare instances he cannot refuse to be influenced by circumstances, and adopt the less promising course, when by its means some hope of saving life exists. I may now say that the deaths which occurred from all causes during or after the conclusion of treatment among the 184 cases of patients averaging 61 years of age, were 12 in number, although one of them, Case No. 49, ought, I think, not to be so reckoned; but I wish to err on the wrong side, and am content to accept 12. This constitutes a rate of recovery of 93 per cent. My first 84 cases included 4 deaths, or a rate of 95 per cent. of recovery. The last 100 were a little less promising, on the grounds named above, and I consider the result, therefore, to be even better than the preceding. For two or three bad cases only, tell heavily against a small per-centage rate of mortality in the total.

The seat and nature of the malady which immediately induces a fatal issue may next be considered. That which appears to have been the most common in these cases is inflammation affecting the kidney of one or both sides. A certain amount of cystitis is common enough in some degree, but usually slight and evanescent in character; it is generally met with at some time or another in cases of lithotrity, where several sittings are necessary. In some individuals, however, invasion of the kidney follows it, and is announced by a severe rigor, succeeded by other rigors at intervals of a few hours. Several severe rigors occurring consecutively, as, say, one or two daily during three or four days, should arouse anxiety on this head. It is rare, indeed, with these signs that some affection of the kidney is absent. Fever continues, and slowly increasing exhaustion, and if recovery does not take place, the patient sinks in from seven to twenty-one days; suppression of urine occasionally, but not generally taking place. The autopsy reveals marked traces of inflammatory action in one or both kidneys and ureters, and mostly deposits of pus are formed in the renal structure and in the course of the ureter. Cases No. 109, 126, 127, 133, 147, 158, more or less illustrate this condition. I am satisfied,

also, that in some or all of these chronic pyelitis, if not chronic nephritis also, has existed, occasioned by the calculous affection, before any operative interference took place. It must be admitted that at present we have not an unfailing means of ascertaining the existence during life of these conditions. There may be no albumen in the urine, and not necessarily are there any deposits in the urine significant of the renal affection. The urine of a calculous patient frequently contains mucus, pus, and blood; but whether the origin of these is in the bladder (naturally its most common source from the irritation of the calculus) or in the organs above it is impossible always to determine, and usually there are no casts or other pathognomonic signs of disorganising renal structure. In fact, neither physical signs nor subjective symptoms are by any means frequently present, and yet advanced pyelitis, and even sometimes chronic nephritis, may exist.

Another cause of death is acute cystitis, apart from any serious renal affection. In such cases the bladder may or may not be sacculated to some extent, most frequently the latter state exists. When these pouches, not by any means necessarily large, have been formed in the bladder, any instrumental interference which is continuous or repeated (such as mere catheterism, for the purpose of relieving an atonied bladder) is liable, not unfrequently, to induce slowly cystitis or pyelitis, which ultimately proves fatal. Cases No. 61, 69, and 80, are examples of death by this way. No. 49 might also be regarded as another instance. The patient was suffering severely from the affection described, and was much exhausted, but he died suddenly while sitting up in bed to a meal from failure in the heart's action.

Lastly, cases 87 and 161 were instances of that affection unhappily liable to follow all surgical proceedings, viz. pyæmia. I imagine there are few operations, however slight, which are followed by so small a number as two in 184 cases. Certainly in any serious operation by the knife the risk of pyæmia is very much greater than this proportion would indicate.

In the paper of Sir Benjamin Brodie already alluded to, in considering the causes of death, he placed them under the two following heads, and I quote his words as most suitable to our purpose here: "First. Cases in which there was a fatal result arising solely from the operation itself. Secondly. Cases in which a similar result was to be attributed to the co-existence of some other disease, brought into an active state by the shock of the operation, but which disease would in itself have been sooner or later the cause of death, even if the operation had not been performed."

Now although it is not possible to draw a hard and fast line by the indications here given, still they furnish a useful and fair classification, by which it will not be difficult to arrange the cases of death before us. I take it for granted that the existence of advanced organic disease of the bladder and of the kidney must be held to place any case exhibiting it in the second category, or that in which death must have occurred, sooner or later, even if the operation had not been performed. Having made numerous anatomical examinations after deaths occurring through disease of the urinary organs, and following surgical operations upon them of various kinds: I may say that the organic changes alluded to are distinctly definable, and they are as follows: 1st. Marked sacculation of the bladder. 2nd. Chronic pyelitis with distended ureter. 3rd. Marked organic changes of a chronic character in the kidney structure.

Could the existence of these conditions be accurately diagnosed beforehand, it might become a question whether the crushing operation, or any operation at all, should be performed. For there is little doubt that the existence of such organic changes is almost as surely a source of fatal issue in lithotomy as in lithotrity. Now, in the twelve cases before us, one or other of these conditions certainly existed in five; and, had it been possible to be aware of them, the operation might not have been performed, and the patient might have lived a little longer—with much suffering it is true—and he ultimately must have died at no distant period. Eliminating these, we have but seven cases out of 184, in

which the death might be attributed to the surgical operation.

The causes in these seven cases were in some mere exhaustion, in others, acute cystitis and fever: both occurring in constitutions of a feeble kind; and pyæmia. And this gives a recovery-rate of 96 per cent., or, in other words, a mortality in the 184 adult cases of not quite 4 per cent.: and this is undoubtedly the fair view to take of the subject.

Table of fatal cases.

In the 184 cases of lithotrity, performed on adults, the mean age of whom was 61 years, 12 deaths occurred. The numbers are as follows, and the causes are appended.

No. 87. Pyæmia.
„ 161. Ditto.
„ 49. Inflammation, acute, or chronic and advanced, of one or both kidneys.
„ 109. Ditto ditto.
„ 126. Ditto ditto.
„ 127. Ditto ditto.
„ 133. Ditto ditto.
„ 147. Ditto ditto.
„ 158. Ditto ditto.
„ 61. Cystitis and pyelitis.
„ 69. Acute cystitis.
„ 80. Ditto.

Five of these were unquestionably subjects of advanced organic disease of the urinary organs before operation, viz., Nos. 49, 61, 109, 127, 133; and must be classed as "cases in which death was to be attributed to the co-existence of some other disease, brought into an active state by the shock of the operation, but which disease would in itself have been sooner or later the cause of death, even if the operation had not been performed."

The details of all will be found under their respective numbers in the appendix.

Secondly.—The general and local condition of patients after lithotrity. This is a subject which has not been studied, perhaps, so much as it deserves. Very little space can be accorded to it here; but there are nevertheless matters of much interest attaching to the after-history of an individual who has formed a stone, and has submitted to an operation issuing in its successful removal. By far the larger number of the patients recorded in my list are living still, quite free from any sign of the old complaint, and enjoying very fair health, age considered. Thus, three were masters of hounds, and above seventy years of age when operated on. Each one has returned to his duties, and two have enjoyed many a hard day's riding since; the third, though not hunting, still attends the meet, and is comfortable in the saddle. If he lives, as there is no reason to doubt, he will hunt next year. Such examples I could adduce in great number throughout the list. So completely true, in most cases, is the axiom which Deschamps chose as the motto of his classical work on stone,

"Causâ sublatâ tollitur effectus."

With a few it is otherwise, and more so in middle life, I think, even than in advanced age. In these exceptional instances a little chronic inflammation still affects the bladder, or it may be the organs above, and impaired health and local troubles of some kind still persist. The operation can but remove the stone, and those troubles which were due solely to its existence. Symptoms due to other causes, associated or not, as the case may be, with calculous formation, will not disappear with the removal of the foreign body.

It would be interesting to know to what extent a kidney, in which a calculus has once been formed, is damaged in the process. Necessarily not much, perhaps, or at all; but sometimes no doubt it is irretrievably deteriorated, and is a cause of future ill health.

Then the irritation produced by the operation itself may

in some cases tell for something in the production of after troubles. But I am bound to say it ought to be exceedingly small. It was formerly not small, with the clumsy apparatus, the enormous lithotrites, evacuating catheters, and repeated washings once thought essential in lithotrity, and now for for the most part swept away from practice. Again, it is not small, if large and angular fragments are dragged through that delicate organism, the neck of the bladder, and along the whole track of the urethra; a practice which more than any one I know has proved damaging in after life to patients, and consequently, to the credit of the operation, of which in reality it forms no part. In order to ensure, first, recovery and subsequently a complete and lasting cure, it is impossible to avoid too sedulously all unnecessary mechanical interference; nor is it possible to conduct all the manipulations with too much care and gentleness. All this holds good equally, within certain limits, in relation to the question of the future re-appearance, or recurrence, as it has been termed, of another calculus in the bladder, and this subject naturally follows here.

Thirdly. Recurrence of calculus. Among the 184 cases, there are 13 in which the calculus has reappeared and in which the operation has been again performed. Let it be repeated here that the mere removal of a few phosphatic debris, subsequently occurring, has not been reckoned as an operation; but only the reformation of a fresh calculus after a year or more of absence on the part of the patient.

Now there are two ways by which calculous matter reappears after an operation of lithotrity. First, there may be a fresh descent from the kidney into the bladder; either a uric-acid or an oxalate of lime formation, and occasionally, but rarely, a phosphatic calculus, may be produced in the pelvis of the kidney, and having found its way into the bladder may form the nucleus of a larger stone, if it is not expelled naturally, or removed by artificial means. This occurrence may follow equally either the cutting or the crushing operation; and does take place in a certain propor-

tion of all cases. It was noted in five of the 184 cases, and at the respective ages of 71, 49, 63, 73, and 74, and the intervals between the first and second stone was in each case, respectively, two years, three years, four years, and in two latter cases one year. Secondly, another and a wholly different mode of calculus formation has to be described; and this is probably somewhat more common than the other. To a certain extent, but not altogether, it is to be accepted as an opprobrium to lithotrity. Happily, the frequency of its occurrence is to be diminished by perfecting the crushing operation in all its details. At the same time it is by no means unknown after lithotomy, although it is rare after that operation. It occurred in 8 cases of the 184, I think it may have occurred in three other individuals, whom I have lost sight of or have since died, but I cannot affirm this. It will be fair I believe to add three, making 11 altogether of recurrence through persisting chronic cystitis, for this is the real cause in most of these cases. If severe prolonged chronic inflammation of the bladder is produced or perpetuated, by mechanical disturbance, due in part to the pre-existence of the stone itself in the organ, in part to the employment of instruments, and in part to the presence of sharp irritating fragments necessarily produced in the operation, it sometimes happens that a large quantity of triple phosphate is rapidly formed within the bladder, and becomes a more or less persisting deposit. If neglected, fresh calculus is very likely to result. No doubt in most cases by much care, by emptying the bladder daily, injecting it, &c., this reproduction may be prevented. In some constitutions the tendency to produce phosphatic deposit thus, is much more marked than in others, and the formation in question by no means corresponds precisely with the degree of inflammation which has been present. A small degree will give rise to it in some individuals; a very large degree will fail to do so in others. Still it is quite clear that the more perfect is the operation of lithotrity, that is, the smaller the amount of irritation produced by the mechanical means employed, the smaller is the risk of its occurrence. Hence

it is unquestionably a sequence of lithotrity, the chance of which is diminishing and has diminished in proportion to improvements in the manner of performing the operation. It is an additional reason, if one were wanting, for avoiding by every means possible, all sources of injury or irritation to the bladder and urethra; such as the forcible removal of large fragments, over-exercise by the patient in the intervals of the sittings, over-instrumentation generally, &c. &c.

In some cases the tendency to form these phosphatic deposits is subdued by treatment, or wears itself out in time. Among the eight patients so troubled, in three cases it persists, in the remaining five it has disappeared altogether. In all cases the morbid product can be always removed easily and the patient relieved, at all events for a time. One cause of persisting phosphatic formation, although a rare one, is beyond doubt encysted calculus. This I have been able to verify. A sac of the bladder, perhaps, usually a small one, contains a calculus, the narrow neck of the sac not permitting the possibility of escape to the foreign body. A small surface of the calculus is thus exposed in the bladder. On this surface phosphatic salts are encrusted, and as the deposit goes on, a more or less spheroidal body is produced, the attachment of which to the encysted calculus is by a narrow and brittle neck. Ultimately this snaps, and a phosphatic calculus is set free in the bladder. This is removed, the symptoms disappear or are much relieved, and the process again commences as before, and is reproduced again and again. I may repeat that I have several times observed this condition; in the dead body not infrequently, in the living three or four times; one of these latter cases was identified by examination with my friend Mr. Cadge, of Norwich, when in consultation on a long and troublesome case of this kind. I have exhibited and recorded several post-mortem examples of this condition at the Pathological Society and elsewhere.

I now come to the important practical conclusion, which I beg to submit is logically derivable from the data before us. It is not offered here as my opinion, or as the opinion of any

other person experienced on this subject; it is a conclusion which the facts recorded inevitably indicate. I have long ago had to contend that lithotrity properly performed is an eminently successful operation; the proof that it is so is now before us. For a certain, and by no means limited, number of cases its success may be regarded as a certainty, absolutely without fear of any contingency, except such as attends the minor operations of surgery—for example, the opening of a small abscess or the removal of a finger. *For I have never lost a single patient in the whole course of my experience after crushing a stone which was no larger than a small nut.* And this is a size at which with very very few exceptions indeed every stone ought to be discovered. But this very fact leads me to remark that the success of lithotrity cannot, therefore, be considered, apart from a knowledge of the extent, in regard of the magnitude of the stone and the constitution of the patient, to which the capabilities of the operation have been pushed.

When it is employed for stones as large as a date or a small chestnut—and it is impossible to deny the excellent chance of success which this method offers to the subjects of such stones—a certain, but still only small proportion of deaths must be expected; and the rate of mortality will correspond with augmentation in the size of the stone, and with the amount of existing disease and age on the part of the patient. Given a small stone in a fairly healthy person, and success is certain; the possibility of contingency in such a case depending only on the presence of those remote and excessively rare conditions which will make for an individual here and there the mere passing of a catheter a cause of death.

As to the extent to which I have pushed the capabilities of the operation here, the formation of a judgment is easy, for the stones are placed before you. Many of them were as large as a small chestnut, some were larger, as may be seen from the *débris*, a portion of which only, I need scarcely say, is present in any case, since some of it always escapes the nurse whose business it is to collect and preserve it.

As to the composition of the calculi, 122 of the 184 were

composed of uric acid and the urates; 40 were phosphatic, 16 were "mixed," 4 were oxalate of lime; 1 was pure phosphate of lime, and 1, a rather large one, was cystic oxide.

The whole have been removed by the two lithotrites produced, one a fenestrated, the other a non-fenestrated or flat-bladed lithotrite, and almost entirely by the latter instrument. Certainly the fenestrated lithotrite has not been used for more than 15 cases, and in these not more than once for each stone: just to divide it into large fragments at the outset. So powerful and capable an instrument is the flat-bladed lithotrite of the construction produced, and so much less likely is it to irritate than the fenestrated instrument.

The recurrence of calculus, common as it was in the earlier history of lithotrity, need be rarely now the result of an overlooked fragment. With the cylindrical handle which I designed for the instrument before you, it is perfectly easy to find a fragment no larger than a split pea, and to elicit a sound audible to bystanders; and equally easy is it, having done so, to seize and withdraw the piece. This I have demonstrated on innumerable occasions, both in private and in hospital practice; and last year in public before M. Verneuil and a large number of students in the wards of Lariboisière in Paris.

The bearing of all this on the results of an operation, the success of which depends on removing the stone completely, and at the same time on avoiding the production of irritation in the organs involved, must be sufficiently obvious.

I have thus far pointed out as briefly as I could what appear to me to be some of the more important facts exhibited by these 184 cases of lithotrity. My object has been to make an impartial estimate of the operation; to ascertain its real value, and its place among surgical operations, and not to make out a special case, either for or against it. The uniformity of the method pursued, the number and the variety of the patients and the record of important facts relative to each, as well as the large proportion of calculi of considerable size, for which it has been employed, produced

for inspection here, are circumstances which constitute this group an excellent opportunity for study, since so complete an appendage of the data necessary to the formation of a judgment has never, as far as I am aware, been given to the profession, either here or elsewhere.

It is a study which I hope to continue, and, whatever results arise in the future, to report them on the same plan which has been adopted to-day.

Note, July 20, 1870.—Since reading the above paper in May, I have operated on eleven fresh patients by lithotrity, of the respective ages of 63, 70, 61, 73, 58, 43, 72, 50, 74, 81, and 59 years without one death: making 195 cases, instead of 184, as the sum total to which the foregoing proportion of accidents may be held to apply.—H. Thompson.

Case 1.—A gentleman at Boulogne, æt. 65; seen in consultation with Dr. Perrochaud there. Two uric-acid stones, medium size. Six sittings, autumn, 1863. Success perfect.

Case 2.—T. P—, æt. 59. University College Hospital. Uric-acid stone. Four sittings, autumn, 1863. Success perfect.

Case 3.—P. B—, æt. 60. University College Hospital. Phosphatic stone, medium size. Bladder perfectly atonied. All urine removed by catheter for years past. Four sittings, autumn, 1863. Success perfect.

Case 4.—A gentleman, æt. 45. Large phosphatic stone. Patient paraplegic. Bladder paralysed. Twelve sittings, autumn, 1863. Success perfect. Seen in consultation with Mr. T. W. Cowell.

Case 5.—A gentleman, æt. 74. Uric-acid stone, medium

size. Seven sittings, January and February, 1864. Seen by Mr. Clover, who gave him chloroform at the patient's special request at first sitting, but was not repeated. Success perfect.

Case 6.—A gentleman, æt. 69. Two uric-acid stones of considerable size. Eighteen sittings, spring, 1864. A patient of Mr. Gayleard, of Devonshire Street, who was present on every occasion. Success perfect.

Case 7.—A gentleman, æt. 70. Phosphatic stone, medium size. Five sittings, October, 1865. Eighteen months had elapsed since the patient had two large uric-acid stones removed. During the first twelve months following he had been free from symptoms. His prostate is remarkably large. Mr. Mapleson was in constant attendance with me. Success perfect.

Case 8.—A gentleman, æt. 45. Uric acid and urates, full medium size. Eight sittings, spring, 1864. Dr. Koepl, of Brussels, who was then in town, was present at two sittings. Success perfect.

Case 9.—A gentleman, æt. 69. Small uric-acid stone. Five sittings. The symptoms disappeared, and he returned home. A fortnight afterwards the patient called on me to complain of a little return of pain. I advised waiting a week or two before sounding. This was at the beginning of June. At the end of the month he had severe rigors and fever, no instruments having been used. He gradually sank in the middle of July. At the autopsy a calculus the size of a bean and smaller ones were found in the right kidney; in the left was a large abscess. In the bladder there were four calculi like those in the kidney, which had probably recently descended. The operation was incapable of removing the graver part of the malady, viz. that of the kidneys. Dr. Koepl was present at the first sitting.

Case 10.—A gentleman, æt. 46. Oxalate of lime, small

medium size. Five sittings, spring, 1864. Dr. Pancoast, of Philadelphia, then in town, was present at one or two of the sittings. Success perfect.

Case 11.—A gentleman, æt. 70. Large mixed calculus. Eleven sittings, summer, 1864. All symptoms of stone disappeared. Some trouble remains with pre-existing enlarged prostate, but he rides, drives, and is actively engaged. Seen two or three times by Mr. M. B. Hill.

Case 12.—A gentleman, æt. 76. A smallish phosphatic stone. Five sittings, April and May, 1864. This case was seen by Sir William Jenner two or three times. Success perfect.

Case 13.—A gentleman, æt. 48. A medium-sized uric-acid stone. Six sittings. Mr. Hilton was present at one sitting. Success perfect.

Case 14.—A gentleman, æt. 69. Large uric-acid stone. Ten sittings, summer, 1864. Mr. M. B. Hill saw this patient frequently; my friend Mr. Norman, of Southsea, also on one occasion. Success perfect.

Case 15.—A gentleman, æt. 68. A rather small calculus, mixed. Five sittings, summer, 1864. Mr. Harris, of Gower Street, present at every sitting. Success perfect.

Case 16.—A gentleman, æt. 48. A rather large uric-acid stone. Eleven sittings, summer, 1864. Mr. Hilton was present at one or two sittings. Success perfect.

Case 17.—A gentleman, æt. 62. Small uric-acid stone. Three sittings, autumn, 1864. Mr. Hammerton was present each time. Success perfect.

Case 18.—A gentleman, æt. 62. Large calculus, uric acid

and urates. Thirteen sittings, autumn, 1864. Dr. Harley present at one sitting. Success perfect.

Case 19.—A gentleman, æt. 59. Small uric-acid stone. One sitting. Mr. Clippingdale saw this case with me in November, 1864. A subsequent severe illness, from which he slowly recovered; but he writes me now that he has "no return of the old complaint."

Case 20.—J. H—, æt. 59. University College Hospital. Rather small uric-acid stone. Eight sittings, November and December, 1864. The calculus could never be found or seized in any other way than with the blades of the lithotrite directed downwards immediately behind the prostate, however high the pelvis was raised. Discharged free from all symptoms.

Case 21.—A gentleman, æt. 75. A rather small phosphatic stone, broken up and removed at one sitting in December, 1864. Mr. Tatham, of Brighton, was present. The patient had long passed no urine except by catheter. This condition, of course, remains, minus the symptoms of stone.

Case 22.—A gentleman, æt. 77. Phosphatic stone. Three sittings. Same patient as No. 21, but eighteen months after previous stone. Successful.

Case 23.—A gentleman, æt. 58. A uric-acid stone of rather more than medium size. Five sittings, December, 1864. Mr. P. Jackson and the late Mr. C. Jackson, of Wimpole Street, were present at each sitting. Success perfect.

Case 24.—A gentleman, æt. 57. A small oxalate-of-lime calculus, crushed at one sitting in November, 1864. Mr. M. B. Hill was present. Successful as far as the removal of the stone is concerned. The patient is still subject to the

formation of small calculi, which he has passed in great number.

Case 25.—A gentleman, æt. 84. Small uric-acid calculus. Five sittings, January, 1865. I had the pleasure of meeting in consultation Mr. Solly several times in this case. Success perfect.

Case 26.—A gentleman, æt. 60. He has passed all his urine by catheter for some years. Smallish phosphatic stone. Six sittings, January, 1865. Mr. Hill saw this case for me several times during a temporary absence. Success perfect.

Case 27.—The same patient, æt. 62. Crushed a second phosphatic stone in autumn, 1866. Three sittings. Since that small portions of phosphatic stone have been removed; but for one year he has been perfectly free from this affection, and is now (1870) in excellent health.

Case 28.—A gentleman, æt. 75. Phosphatic stone, medium size. Seven sittings, April and May, 1865. Prostate large; bladder has not been emptied without catheter for years. This case had the advantage of Mr. Aikin's constant care and attention. Success perfect.

Case 29.—The same gentleman. Had perfect immunity from stone for one year and a half, then symptoms reappeared, and I again removed a considerable stone in six sittings with perfect success.

Case 30.—A gentleman, æt. 61. Large uric-acid stone. Ten sittings, April and May, 1865. Dr. A. Simpson, of Glasgow, and Mr. M. B. Hill saw this case several times. Success perfect.

Case 31.—A gentleman, æt. 59. A large phosphatic stone; disease of kidneys. Eight sittings, April and May,

1865. A patient of Dr. Sharpe, of Norwood, who frequently saw him with me. Success perfect.

Case 32.—A gentleman, æt. 65. Rather small uric-acid stone. Four sittings, April and May, 1865. Seen by Mr. M. B. Hill, also by Dr. Van Buren, of New York. Success perfect.

Case 33.—A gentleman, æt. 53. Uric-acid stone, medium size. Eight sittings, April and May, 1865. Seen by Dr. A. Simpson, of Glasgow, and by others. Success perfect.

Case 34.—B—, æt. 62. University College Hospital. Small phosphatic stone. Three sittings, April and May, 1865. Recovered. About five months after he died of cancer in the bladder. (See Hospital "Mirror," December 16, 1865.)

Case 35.—A gentleman, æt. 71. Two or three smallish uric-acid stones. Nine sittings, April, May, and June, 1865. All removed and greatly relieved, but now a tendency to deposit phosphates; removed by washing out the bladder. Often seen by Dr. A. Simpson and others.

Case 36.—A gentleman, æt. 70. Medium size phosphatic stone, with, perhaps, few urates. Five sittings. Very large prostate. Success perfect.

Case 37.—B—, æt. 28. University College Hospital. Hard phosphatic stone of medium size. Six sittings, May, 1865. Success perfect. (See the 'Lancet,' Hospital "Mirror," December 16, 1865.)

Case 38.—A gentleman, æt. 62. Rather small uric-acid stone. Three sittings, May, 1865. Seen by Mr. Clover, who gave chloroform. Success perfect.

Case 39.—A gentleman, æt. 74. Small medium uric acid.

Four sittings, May and June, 1865. Prostate very large. M. C. King, of Highbury, was in constant attendance with me. Success perfect.

Case 40.—A gentleman, æt. 70. Large uric-acid stone. Nine sittings, May and June, 1865. Prostate large. Mr. M. B. Hill watched this case constantly with me. Mr. Clover gave chloroform. Success perfect.

Case 41.—A gentleman, æt. 62. Medium sized, uric acid. Seven sittings, June and July, 1865. Stone completely removed. Greatly relieved, but some derangement of the bladder continues. Seen also several times by Mr. B. Hill.

Case 42.—A gentleman, æt. 61. Uric acid, of medium size. Seven sittings, June and July, 1865. This patient was well known to Dr. Greenhow, who saw him occasionally. Success perfect.

Case 43.—B—, æt. 39. University College Hospital. Small phosphatic stone. Three sittings, June and July, 1865. Sent to me by Dr. U. West, of Alford. Success perfect.

Case 44.—A gentleman, æt. 69. Two calculi, medium size, mixed phosphates and urates. Seven sittings, June and July, 1865. Seen with me several times by Dr. Buchanan, of Glasgow. This patient had been cut in Edinburgh three years before, and two uric-acid stones removed, but smaller than the present. Success perfect.

Case 45.—A gentleman, æt. 47. Phosphatic stone, medium size. Five sittings, September and October, 1865. The patient had been under the care of Mr. Rhind, of Shipley, Yorkshire, who advised him to undergo the operation. Success perfect.

Case 46.—A gentleman, æt. 65. Uric acid, of large medium size. Seven sittings, October, 1865. This patient was sent to me by Mr. Warwick, of Southwell. Success perfect.

Case 47.—A gentleman, æt. 64. Uric acid, of medium size. Four sittings, October, 1865. Seen by Mr. M. B. Hill, Dr. Seegen, of Vienna, and by others.

Case 48.—A gentleman, æt. 65. Small, uric acid. Two sittings, October, 1865. Mr. Clover gave chloroform. Success perfect.

Case 49.—A gentleman, æt. 64. Medium size, hard, phosphatic stone. November and December, 1865. I stated at my first consultation with Mr. E. Wright, of Clapham, with whom I had the opportunity of frequently seeing this patient, that the case was unpromising, either for lithotomy or lithotrity; but that his symptoms being severe, I could not refuse the chance afforded by the latter operation. I also thought it necessary to make the same statement to his relatives before commencing. The prostate was exceedingly large, the cavity of the bladder small, and the stone difficult to seize. Besides this he had organic disease of the heart. Without detailing all the particulars which were adverse to success in this case, I may say that it presented as many difficulties as any case which it has fallen to my lot to encounter. In Paris I am satisfied that this operation would have been declined; but his condition was so hopeless and so miserable without it, that I did not think it right to refuse him the chance. There were five sittings during the first month, conducted with the greatest care. Then fever set in; he gradually became weaker, and died suddenly while sitting up in bed and taking food, about a month after the last sitting, although he had rallied so much at times as to afford great hope of ultimate success. At the autopsy considerable suppuration was found about the base of the bladder. One half of the stone was removed, the other half remaining in

the best condition—that is, in one piece, all the débris having been removed. I am satisfied to accept this as a death following the operation of lithotrity, although the actual cause of death at the last was clearly diseased heart, because the suppuration in the pelvis would have been almost necessarily fatal. It would have been politic to decline this case, but not right, I think, all things considered, to refuse the chance which the exercise of great care and gentleness in management might offer him, and I therefore consented. Had I not done so, there would not have been one fatal case. As it is, there is one out of twenty-four cases in this year. Reckoning the nineteen antecedent cases of 1864, it was the first death after a series of forty-three consecutive successful cases.

Case 50.—A gentleman, æt. 66. Large, uric acid. Eight sittings, November and December, 1865. The patient was sent to me by Mr. Foster, of Huntingdon. The stone is completely removed, and its symptoms have disappeared. At present a good deal of irritation remains, with phosphatic deposit.

Case 51.—A gentleman, æt. 69. Very large phosphatic stone. Eight sittings, December, 1865, and January, 1866. Seen with me by Mr. W. Morris, of Petworth. Success perfect.

Case 52.—A gentleman, æt. 56. Two rather small uric-acid stones. Five sittings, December, 1865, January, 1866. Seen also by his medical man, Mr. W. Morris. Success perfect.

Case 53.—A gentleman, æt. 65. Several hard phosphatic stones; severe disease of bladder. Five sittings, January, 1866. Seen, with me, by Mr. Foster, of Huntingdon. Success perfect.

Case 54.—A gentleman, æt. 53. Stones, uric acid and

phosphatic, mixed. Eight sittings. Disease of bladder, and tendency to produce phosphatic matter, subsequently for some months. Finally cured, and now in a state of comfort, January and February, 1866. Sent to me by the late Dr. Brinton, and known to Dr. Phillips, of Coventry.

Case 55.—A gentleman, æt. 67. Rather small uric-acid stone. Three sittings, January, 1866. Known to Mr. C. S. Webber. At this and all the foregoing cases Dr. Mazanowski, of St. Petersburg, was present. Success perfect.

Case 56.—A gentleman, æt. 67. Large medium size uric-acid stone. Nine sittings, January and February, 1866. This case was seen throughout by Mr. John Foster, of Upper Wimpole Street. Success perfect.

Case 57.—A gentleman, æt. 66. Small uric-acid stone. Two sittings, January, 1866. Extreme fever following, from which he made a perfect recovery. He was seen throughout by his medical attendant, Dr. Monckton, of Maidstone.

Case 58.—A gentleman, æt. 63. Medium-sized uric-acid stone. Five sittings, February, 1866. Seen by Dr. Charles Mayo, and Dr. Taylor, of Guildford. Success perfect.

Case 59.—A gentleman, æt. 72. Large phosphatic stone. Six sittings, February, 1866. Seen, with me, by Mr. Charles Butler, of Ingatestone. Success perfect.

Case 60.—The same patient, about a year afterwards, applied with another stone, phosphatic, considerable size. Four sittings. He passes all his urine by catheter, and has had no return of the formation since (1870), and is in excellent health.

Case 61.—A gentleman, æt. 69, with very advanced disease of the bladder, and enormously enlarged prostate; but he was suffering so severely from several hard phosphatic stones, and

with exhaustion therefrom, that I could not decline to make an attempt to remove them, notwithstanding his very unpromising condition. He gradually sank from debility. Seen throughout by Mr. W. S. Foster, of Newport.

Case 62.—A gentleman, æt. 74. Large uric-acid calculus. Six sittings, chiefly under the influence of chloroform, given by Mr. Clover, and much débris removed, March, 1866. Has hunted regularly this present season. Success perfect.

Case 63.—A gentleman, æt. 56. Rather small uric-acid stone. Four sittings, March and April, 1866. Attended throughout by Mr. John Foster, of Upper Wimpole Street. Success perfect.

Case 64.—A gentleman, æt. 70. Several uric-acid stones. Six sittings, March and April, 1866. Seen, with me, by Dr. Radcliffe. Success perfect.

Case 65.—A gentleman, æt. 48. Phosphatic stone. Four sittings. March and April, 1866. This patient was seen, with me, by Dr. Hudson, of Cork Street. Success perfect.

Case 66.—A gentleman, æt. 67. Rather small uric-acid calculus. Four sittings, April, 1866. Seen, with me, by Dr. Owen Rees. Success perfect.

Case 67.—T. H—, æt. 49. University College Hospital. Two rather large uric-acid stones. Eight sittings, May and June, 1866. Success perfect.

Case 68.—D. E—, æt. 39. University College Hospital. A large uric-acid stone. Seven sittings, June and July, 1866. Success perfect.

Case 69.—A gentleman, æt. 73, with a very large and hard uric-acid stone. He was very much averse to lithotomy, which would, perhaps, have been better for him; and I con-

sented to crush the stone. It turned out to be even a little larger than I anticipated. It was entirely removed in several sittings, but he succumbed to fever and exhaustion from severe cystitis. June and July, 1866.

Case 70.—A gentleman, æt. 67. A medium size phosphatic stone. Renal disease existed, œdema of the legs, and advanced disease of the bladder. There was complete phymosis. The urethra was blocked with phosphatic débris, and the urine dribbled off involuntarily. I operated first on the urethra and cleared it, then crushed the stone, in five sittings, with perfect success. All his other symptoms have been greatly relieved since, and he has no trouble whatever now with the bladder or urethra, May and June, 1866. Seen, with me, by Mr. P. C. Chadwick, of Wrington.

Case 71.—A gentleman, æt. 70. Five or six small uric acid stones. Six sittings, June and July, 1866. Mr. Swaine, of Devonport, was present at one sitting. Success perfect.

Case 72.—A gentleman, æt. 55. Medium-sized hard phosphatic stone. Five sittings, July, 1866. Attended throughout by Mr. John Foster, of Upper Wimpole Street. Success perfect.

Case 73.—W. M—, æt. 40. University College Hospital. A man, with advanced renal disease, whose symptoms were aggravated by the presence of two or three phosphatic calculi in the bladder. These were removed in three sittings, July, 1866, and he left the hospital with his bladder free from calculous matter, and was so far relieved. He died from the organic disease of the kidneys ultimately.

Case 74.—R. W—, æt. 52. University College Hospital. Enormously large and hard phosphatic stone. Fifteen sittings, October and November, 1866. He had been the subject of lithotomy before. Success perfect.

Case 75.—A gentleman, æt. 76. Two uric-acid calculi of small medium size. Five sittings, October and November, 1866. Was also under the care of Mr. Blaker, of Brighton. Success perfect.

Case 76.—R. E—, æt. 60. University College Hospital. Mixed uric acid and phosphates. Four sittings, November, 1866. Success perfect.

Case 77.—A gentleman, æt. 54. Medium-sized uric-acid stone. Five sittings, November and December, 1866. Was also under the care of Dr. Lionel Beale. Success perfect.

Case 78.—A gentleman, æt. 75. Large uric-acid stone. Six sittings under chloroform, December, 1866. Was seen with me throughout by Dr. F. Davies, of Gower Street. Success perfect.

Case 79.—A lady, æt. 64. Uric-acid stone, rather small. Removed in two sittings, December, 1866. Seen with Dr. Owen Rees. Success perfect.

Case 80.—A gentleman, æt. 80. Uric-acid stone, full medium size. Four sittings, January, 1867. Notwithstanding his age he appeared to be a hale, strong man. After the second sitting severe cystitis came on, and he sank rapidly from exhaustion. Seen with Mr. Clover.

Case 81.—T. G., æt. 70. University College Hospital. Mixed urates and phosphates. Five sittings, January, 1867. Discharged free from stone, but with much trouble resulting from enlarged prostate and irritable bladder.

Case 82.—A gentleman, æt. 69. Large phosphatic stone. Six sittings, spring, 1867. Much relieved, but a good deal of irritation of bladder continues. A similar calculus was crushed for him six years ago, and he has never been free from phosphatic deposit since. Seen in consultation with Dr. O. Rees.

Case 83.—A gentleman, æt. 61. Uric-acid stone, small medium size. Four sittings, spring, 1867. Sent to me by Dr. Seegen, of Carlsbad. Success perfect.

Case 84.—A gentleman, æt. 63. Three or four smallish uric-acid stones. Five sittings, spring, 1867. Seen throughout by Mr. John Foster, of Upper Wimpole Street. Success perfect.

Case 85.—A gentleman, æt. 57. Very large uric-acid calculus. Ten sittings, spring, 1867. Seen with Mr. R. Lamb, of Barnsbury. Success perfect.

Case 86.—Dr. C—, æt. 71. Medium size, phosphatic. Seven sittings, April and May, 1867. Success perfect.

Case 87.—A gentleman, æt. 59. Medium-sized uric-acid. Two sittings, April, 1867. Pyæmia and death. He had two easy sittings within five days, without a bad symptom. Two days after, fever and swelling on right side of neck. In two days more breathing was difficult; next day pain in the abdomen; on the following day he died. An extremely large abscess was found deeply seated at the base of the neck, the result of pyæmia, and others were commencing elsewhere. Seen with Mr. Marshall, of Bedford Square.

Case 88.—A gentleman, æt. 77. Two or three small uric-acid stones. Six sittings, April and May, 1867. Seen with Mr. Newton, of Upper Wimpole Street. Success perfect.

Case 89.—A lady, æt. 42. A large phosphatic stone. Two sittings, May, 1867. With Dr. Meadows, of London. Success perfect.

Case 90.—A gentleman, æt. 64. Medium-sized uric-acid. Five sittings, May and June, 1867. Seen by Dr. Gibson, of Dundee. Success perfect.

Case 91.—A gentleman, æt. 42. Small phosphatic. Two sittings, May, 1867. Operation for stricture at the same. Mr. Clover gave chloroform. Success perfect.

Case 92.—A gentleman, æt. 66. Small uric-acid. One sitting, May, 1867. Seen by Dr. Allen. Success perfect.

Case 93.—A gentleman, æt. 35. Small phosphatic. Two sittings, June, 1867. Seen with Mr. Price, of Stamford Hill. Success perfect.

Case 94.—A gentleman, æt. 61. Large uric-acid. Eight sittings, June and July, 1867. Seen by Dr. Heslop, of Birmingham. Success perfect.

Case 95.—A gentleman, æt. 71. Numerous small uric-acid calculi, perhaps forty. Three sittings, July, 1867. Seen by Dr. Painter. Much relieved.

Case 96.—A gentleman, æt. 81. Large cystic oxide. Nine sittings, July and August, 1867. This case has been seen by several of my professional brethren, the extreme rarity of the formation rendering it one of great interest. The success was perfect, and the gentleman is enjoying excellent health at the present time (1870).

Case 97.—A gentleman, æt. 67. Rather small uric-acid. Four sittings, July, 1867. Success perfect.

Case 98.—A gentleman, æt. 65. Two uric-acid stones. Six sittings, October, 1867. Sent by Dr. Thomas Keith, of Edinburgh. Success perfect.

Case 99.—A gentleman, æt. 71. Small uric-acid. Four sittings, October, 1867. Mr. Clover gave chloroform. Success perfect.

Case 100.—A gentleman, æt. 59. Three or four uric-acid

stones, small. Six sittings, August, 1867. Seen by Dr. John Murray. Success perfect.

Case 101.—A gentleman, æt. 57. Medium-sized calculus, mixed phosphates and urates. Six or seven sittings, autumn, 1867. Relieved.

Case 102.—A gentleman, æt. 60. Numerous rather small uric-acid calculi. Ten sittings, November and December, 1867. Seen by Dr. Nash, of Notting Hill. Success perfect.

Case 103.—A gentleman, æt. 41. Small uric-acid. Three sittings, November, 1867. Mr. C. Heath was present at the first sitting. Success perfect.

Case 104.—A gentleman, æt. 47. Large uric-acid. Nine sittings, December, 1867. Seen by Mr. Pritchard, of Retford. Success perfect.

Case 105.—J. S—, æt. 55. University College Hospital. Mixed calculus, medium size. Five sittings, January, 1868. Success perfect.

Case 106.—S. R—, æt. 50. University College Hospital. Rather small uric-acid. Six sittings, January and February, 1868. Success perfect.

Case 107.—G. S—, æt. 51. University College Hospital. Large uric-acid. Nine sittings, February and March, 1868. Success perfect.

Case 108.—E. B—, æt. 55. University College Hospital. Two medium size uric-acid. Eight sittings, January and February, 1868. Success perfect.

Case 109.—A gentleman, æt. 68. Large uric-acid stone. This gentleman came from Paris, and was one of the most nervous and susceptible patients that I ever had to treat. I

should have preferred to do lithotomy, but he would not listen to the proposal. I consented to crush, but towards the conclusion of the case, when nearly all the stone was removed, he sank from fever and exhaustion.

Case 110.—A gentleman, æt. 58. Several small uric-acid calculi. Five sittings, February, 1868. He was the subject of stricture and also of diabetes. The calculi were successfully removed by means of a small lithotrite constructed for the purpose. Dr. Ringer gave chloroform.

Case 111.—A gentleman, æt. 76. Two uric-acid stones. Eight sittings, February and March, 1868. Sir Thomas Watson saw this case. Success perfect.

Case 112.—A gentleman, æt. 76. Rather small uric-acid stone. Four sittings, April, 1868. Success perfect.

Case 113.—J. K—, æt. 35. University College Hospital. Rather small uric-acid. Three sittings, April, 1868. Success perfect.

Case 114.—S. C—, æt. 58. University College Hospital. Medium-sized uric-acid. Five sittings, April and May, 1868. After the operation was finished, and he was awaiting only the final search for a last fragment, he caught cold, and had sore throat followed by œdema glottidis, for which laryngotomy was performed. He apparently recovered in a week's time, and the tube was removed. Ten days after this the œdema reappeared. The wound was reopened and the tube introduced; but he gradually sank in three or four days. The post-mortem examination showed the bladder to be perfectly healthy, and one tiny piece of débris only remained. This death cannot therefore be reckoned to lithotrity.

Case 115.—A gentleman, æt. 49. Medium-sized uric-acid. Five sittings, May, 1868. Dr. Keith, of Aberdeen, was present at one sitting. Success perfect. This case is the

same as No. 8. He had no symptoms for three years. A new uric-acid stone has existed, according to symptoms, about twelve months.

Case 116.—A gentleman, æt. 62. Medium-sized uric-acid stone. Five sittings, May, 1868. Dr. Keith, of Aberdeen, present at one of the sittings. Success perfect.

Case 117.—A gentleman, æt. 65. Two rather large uric-acid stones. Thirteen sittings, June and July, 1868. Dr. Ringer gave chloroform. Success perfect.

Case 118.—A gentleman, æt. 62. Several small uric-acid stones. Six sittings, June, 1868. Seen by Dr. Pakeman, of Ware. Success perfect.

Case 119.—A gentleman, æt. 58. Medium-sized uric-acid. Five sittings, May and June, 1868. Seen by Mr. R. Phillips. Success perfect.

Case 120.—A gentleman, æt. 60. Small oxalate-of-lime. One sitting, May, 1868. Seen with Mr. Aikin. Success perfect.

Case 121.—A gentleman, æt. 59. Mixed uric-acid and phosphates. Five sittings, June and July, 1868. Seen by Mr. Aikin. Success perfect.

Case 122.—A gentleman, æt. 71. A phosphatic stone, medium size. Four sittings, summer, 1868. The same patient as No. 82, for whom I crushed a stone two years before. He is liable to the formation of small phosphatic masses from time to time, which have to be removed, although otherwise now in good health (1870).

Case 123.—A gentleman, æt. 73. Uric-acid, rather small size. Three sittings, April, 1868. Same case as No. 40. He had perfect freedom from all symptoms until about three

months ago, when their reappearance led me to sound him, and I found a new formation, which has been removed with perfect success.

Case 124.—A gentleman, æt. 70. Three uric-acid stones, rather small. Six sittings, July, 1868. Seen by Dr. Gavin Milroy. Success perfect.

Case 125.—Dr. P—, æt. 65. Uric-acid, rather small. Three sittings, July, 1868. Success perfect.

Case 126.—G. B—, æt. 70. University College Hospital. Full medium-sized uric-acid, July, 1868. Two days after first crushing, much débris having been passed, he had a severe rigor. Next day complete suppression of urine for thirty hours. Urine then reappeared and was perfectly clear. On the next day rigors again, and two days after he died; the urine having continued perfectly clear up to the last. At the post-mortem examination the bladder was found free from any sign of inflammation, rather more than half the calculus in one piece was found there, the rest having been passed. One of the kidneys was healthy, the other showed marks of recent severe inflammation. No sign of disease elsewhere. I assume that this man rapidly succumbed to an acute attack of nephritis of one side. It is a remarkable circumstance, but not without parallel in my experience, that this state of the kidney should occur after an operation on the bladder, without any inflammation of that organ, the urine being clear to the last.

Case 127.—A gentleman, æt. 72. Large uric-acid stone. I decided to perform lithotrity in this case, although I now believe lithotomy would have been preferable. The size of the calculus was considered to be just within the reach of the crushing operation; a size for which it is impossible to say decisively beforehand which of the two operations was preferable. Under these circumstances the patient's strongly expressed wishes decided the question. During October I

crushed seven times, the patient suffered severely in passing débris. At the end of the month he had a severe attack of suppression. The urine was clear, and I have no doubt that the pathological condition very much resembled that of the preceding case. He greatly improved, so that in November I crushed again, having disposed of nearly all the stone. He gradually sank and died a few days after. At the post-mortem examination the right kidney was found to be the subject of well-marked fatty degeneration, the left showed marks of recent inflammation, and contained an abscess. Two or three small fragments were found in the bladder. He had been under the care of Dr. Bayntun, of Bath.

Case 128.—A gentleman, æt. 58. Uric-acid stone. Four sittings, October, 1868. Seen with Mr. Price, of Dublin. Success perfect.

Case 129.—A gentleman, æt. 52. Uric-acid. Small medium. Four sittings, October, 1868. Seen with Mr. Newnham, of Wolverhampton. Success perfect.

Case 130.—J. L—, æt. 63. University College Hospital. Uric-acid. Small medium. Seven sittings, October, 1868. The stone was successfully removed. A good deal of irritation remained, but this gradually subsided.

Case 131.—A gentleman, æt. 49. Rather large mixed urates and phosphate. Nine sittings, October and November, 1868. Seen with Dr. Macaldin, of Islington. Success perfect.

Case 132.—J. H—, æt. 63. University College Hospital. Uric-acid. Small medium-sized. Four sittings, October, 1868. Success perfect. Same case as No. 20, crushed four years before. Had immunity from symptoms three years; then formed a new uric-acid stone, of which he has had symptoms during the past year.

Case 133.—W. W—, æt. 65. University College Hospital. A large urie-acid stone. After ten sittings, during the months of October and November, 1868, by which the greater part of the stone was removed, he had much fever and cystitis. During the next fortnight he gradually sank. At the post-mortem the bladder showed marks of chronic inflammation. One kidney was tolerably healthy, the other was largely diseased, with deposits of pus in the pelvis and along the ureter to the kidney. The patient was feeble at first, or I should have performed lithotomy, which, after all, might have been the safer proceeding for a stone of this size.

Case 134.—A gentleman, æt. 61. Phosphatic stone, small medium size. Three sittings, October, 1868. Successful. This patient has passed all his urine by catheter for several months, and is the same as No. 102. He has a tendency to produce phosphatic matter in the bladder, and it is occasionally removed. The tendency is gradually diminishing, and he is in good health (1870).

Case 135.—A gentleman, æt. 64. Several rather small uric-acid stones. Six sittings, October and November, 1868. Relieved subsequently, that is, five months afterwards; two small calculi removed by lithotomy with perfect success. Seen by Sir William Fergusson and others.

Case 136.—A gentleman, æt. 51. Large urie-acid. Ten sittings, October and November, 1868. Seen with Dr. Langmore. Success perfect.

Case 137.—A gentleman, æt. 73. Several rather small uric-acid stones. Eight sittings, October and November, 1868. Seen with Mr. Garlick, of Bloomsbury. Success perfect.

Case 138.—A gentleman, æt. 68. Very feeble, requiring constant catheterism. Stone small medium. Mixed urates

and oxalates. Five sittings, November, 1868. Seen with Mr. Barrett, of Welshpool. He made a good recovery and returned to the country, having learned to pass the catheter for himself. Subsequently he had severe fever, and shortly after died.

Case 139.—A gentleman, æt. 59. Rather small uric-acid stone. Three sittings, December, 1868. A patient of Dr. Dansey, of Devonport. Success perfect.

Case 140.—T. R—, æt. 29. University College Hospital. A large phosphatic stone; advanced disease of kidneys. This patient entered the hospital in a low condition of health. I dared not submit him to the knife, and resolved to offer him his only chance of temporary relief, by lithotrity. His case much resembled that of No. 31, in which I successfully relieved a patient with long-standing Bright's disease, of a large phosphatic stone, and who had nearly twelve months of comfortable existence afterwards. I made two small crushings in the end of November, 1868, and he passed some débris. But his condition did not encourage me to proceed, and I did not repeat the attempt. He had a large amount of albumen in the urine, and gradually sank in two or three weeks. At the post-mortem there were well-marked signs of chronic disease of one kidney, with abscess, chronic cystitis, and two large portions of phosphate of lime calculus in the bladder. The death must be attributed to the renal affection.

Case 141.—A Turkish gentleman, from Constantinople, æt. 48. A medium-sized uric-acid stone. Five sittings, January and February, 1869. Seen with Mr. J. G. Forbes, of Hyde Park. Success perfect.

Case 142.—A gentleman, æt. 67. Small medium uric-acid. Five sittings, February, 1869. Seen by Dr. M'Cleod, of Glasgow. Success perfect.

Case 143.—A gentleman, æt. 32. Two small uric-acid

stones. Three sittings, October, 1868. Mr. Newnham, of Wolverhampton, was present at one sitting. Success perfect.

Case 144.—A gentleman, æt. 79. Two or three hard phosphatic calculi. Nine sittings, February and March, 1869. Seen with Mr. Taylor, of Clapham. Success perfect.

Case 145.—A gentleman, æt. 67. Three uric-acid calculi. Seven sittings, February, 1869. Seen in consultation with his medical attendant, Mr. Bostock, of Horsham. Success perfect.

Case 146.—A gentleman, æt. 74. Uric-acid medium-size. Eight sittings, February and March, 1869. Conjointly under the care of Mr. Clover and myself. Success perfect.

Case 147.—A gentleman, æt. 62. Uric-acid, of rather small medium size. Seen in consultation with Dr. R. Mc Donnell, of Dublin. I crushed the stone easily and rapidly on the 31st March, 1869. No frequency of micturition; a fever during the first three days. Appetite good and in all respects well. At the end of that time he had an attack of rigors; urine was retained, became bloody, required the catheter, and in spite of unremitting attention he gradually sank with increasing fever, and died on April 17. There seemed to be a peculiar want of reparative power in this patient. To the last he ate and drank well of solid food, like a healthy man, but notwithstanding gradually and steadily declined. There was no autopsy.

Case 148.—A gentleman, æt. 73. Two mixed calculi of considerable size; urates and oxalate of lime. Fourteen sittings, spring, 1869. Seen conjointly with Dr. O. C. Maurice, of Reading. Success perfect.

Case 149.—A gentleman, æt. 73. Small medium, mixed

urates and phosphates. Four sittings, April, 1869. Seen by Mr. Clover, who gave chloroform. Success perfect. The same patient as No. 99. He passed fresh uric-acid calculi, and had much phosphatic deposit with them. He has now been perfectly free for one year, and is quite well (1870).

Case 150.—A gentleman, æt. 66. Large phosphatic stone. Seven sittings, spring, 1869. Dr. Ringer gave chloroform. Success perfect. The same patient as No. 117, a tendency to form phosphatic deposit after the first operation, which has since quite disappeared, and he is now perfectly well (1870).

Case 151.—A gentleman, æt. 72. Rather small uric-acid stone. Five sittings, May, 1869. The general progress of this patient, seen in consultation with Mr. Macilwain, during the operation was satisfactory. He had a little fever, was occasionally rather low, and consequently each crushing was made as short as possible. He had an enormous prostate, which was in some degree disadvantageous for him. At the termination of the case some cerebral symptoms occurred, and I had the advantage of Dr. Owen Rees' opinion. No albuminuria was present. On the 1st of June symptoms of effusion on the brain suddenly appeared, and he died in a few hours. In this case it is impossible to consider the operation as the cause of death. That there had been cerebral changes of long standing little doubt could exist, and in so far as the operation weakened and disturbed the patient, its effect must have been prejudicial, but to this extent only can any casual relation be admitted.

Case 152.—A gentleman, æt. 56. Rather small uric-acid stone. Two sittings, May, 1869. Seen conjointly with Dr. Connor, of Battersea. Success perfect.

Case 153.—A gentleman, æt. 66. Several small uric-acid calculi, the aggregate being considerable. Seven sittings, June, 1869. Seen conjointly with Dr. Cribb, of Highbury. Success perfect.

Case 154.—A gentleman, æt. 76. Uric-acid, small medium size. Four sittings, June, 1869. Seen conjointly with Sir William Fergusson. Success perfect.

Case 155.—J. W—, æt. 50. University College Hospital. Mixed calculus, uric acid and phosphates, medium size. Four sittings, summer, 1869. Success perfect.

Case 156.—A gentleman, æt. 57. Rather small phosphates. Two sittings, summer, 1869. I crushed an oxalate-of-lime calculus for this gentleman in 1864, with the late Mr. Ray, of Dulwich (case No. 24). There had been no intermediate formation. Success perfect.

Case 157.—R. H. W—, æt. 26. University College Hospital. A man in the third stage of phthisis, with large cavities, was transferred from a medical ward to one of mine in June, 1869, with severe symptoms of stone. I found a small calculus, mixed oxalate-of-lime and uric acid, which I crushed in two sittings. He was sent back, free from his urinary troubles, to the physician's ward, where I believe he ultimately died of phthisis.

Case 158.—A gentleman, æt. 55. Uric-acid stone of medium size. Six sittings, July, 1869. Seen conjointly with Sir William Watson, Dr. Hassall, and others. Nothing apparently could be more promising than the aspect, temperament, and condition of this patient at the commencement. The first two or three sittings were followed by slight and nausient feverish attacks, but the urine gradually became charged with much blood and mucus, and this to an extent not easily to be accounted for. This condition seemed to be due to the presence of numerous sharp fragments, at the same time débris did not pass well by the natural efforts. Soon the patient became unable to pass more than a small quantity of urine by his own efforts, and catheterism several times a day became necessary. Meantime the patient, who took nourishment well, and was to a remarkable extent in

stamina and disposition all that his surgeon could desire, gradually declined, and the local condition steadily got worse. The question arose whether the bladder should be at once emptied by lithotomy, or by crushing and with the use of Clover's instrument; and on this point I had the advantage of the opinion of my friend, Sir William Fergusson. We decided on the latter proceeding, and eventually the whole of the stone was removed in the middle of July. After this the patient continued very much in the same state, with a quick pulse, hectic flush, and using his own catheter, which he had learned to pass easily several times in the twenty-four hours. At the end of the month he appeared to improve, and took drives in the open air, going to his country house on the 30th July. I saw him there next day; he took a little walking exercise, was cheerful, and looked better, but the quick pulse existed, and frequent catheterism was necessary, the urine secreted being remarkably large in quantity, but free from constitutional albumen or sugar. Day by day he became more exhausted, and he sank gradually on August 11th. There was no autopsy, but I have no question of the existence of considerable suppurative pyelitis on one or both sides, and probably of chronic inflammation affecting the kidney itself.

Case 159.—A Russian medical man, æt. 47. Uric-acid medium-size. Five sittings. This gentleman travelled from a remote part of Siberia, for the purpose of the operation, and returned perfectly well after not quite four weeks' residence in London. He was seen by several medical men here, who were interested in him as a brother practitioner.

Case 160.—A gentleman, æt. 60, a judge in California, who came to me for the operation. Large uric-acid. Seven sittings, July and August. Mr. Clover gave chloroform. This and the two previous patients were seen also by Dr. Stilling, of Hesse Cassel. Success perfect.

Case 161.—A gentleman, æt. 62. Uric-acid small

medium. A German gentleman of extremely irritable temperament, July, 1869. After the second crushing, he had a severe rigor, and soon after pyæmia with affection of the joints, and died in ten days. Seen with Dr. Bäumler, of Finsbury Place.

Case 162.—A gentleman, æt. 61. Uric-acid medium-size. Six sittings, October, 1869. He ultimately made a good recovery, rendered slow by severe orchitis. Sent to me by Dr. Savile, of East Retford.

Case 163.—A gentleman, æt. 52. Uric-acid, rather small. Five sittings, autumn, 1869. Success perfect.

Case 164.—A gentleman, æt. 61. Uric-acid, small medium. Four sittings, autumn, 1869. Seen with Mr. Ryott, of Newbury, who also saw the previous patient.

Case 165.—W. B—, æt. 65. University College Hospital. Large uric-acid stone. Nine sittings, October and November, 1869. Sent to me by Dr. Druitt, of Wimborne. Discharged cured, end of November.

Case 166.—W. L—, æt. 57. University College Hospital. Uric-acid, rather large. Nine sittings, October and November, 1869. Discharged convalescent in December, but with some irritation of the bladder. Returned to me in March, 1870, with a small phosphatic formation, which was rapidly removed. He is recovering by the daily use of injections into the bladder. Sent to me by Mr. Jalland, of Horncastle.

Case 167.—J. M—, æt. 69. University College Hospital. Urate of soda calculus, large. Seven sittings, October and November, 1869. Sent to me by Dr. Canham, of Ramsgate. Success perfect.

Case 168.—W. W—, æt. 65. University College

Hospital. Uric-acid, large medium. Eight sittings. Much fever and debility; discharged relieved end of November, but in a very weak condition.

Case 169.—A gentleman, æt. 48. A medical man from the country. Urate of soda, medium size. Four sittings, November, 1869. The urgencies of practice compelled this patient to leave immediately after the last sitting, but successfully relieved of his calculus and with rapidly improving symptoms.

Case 170.—A gentleman, æt. 73. Rather small phosphatic calculus, crushed at one sitting, December, 1869. Mr. Clover gave chloroform. Success perfect.

Case 171.—A gentleman, æt. 75. Urate of soda. Calculus of large medium size. Removed in five large crushings under chloroform, December, 1869. Seen conjointly with Dr. Pavy. Success perfect.

Case 172.—A gentleman, æt. 59. A medical man from Ireland. Uric-acid, large medium. Six sittings, November and December, 1869. He was much relieved, but his professional duties removed him from my care much sooner than was desirable.

Case 173.—A gentleman, æt. 40. A medical man from the country. Uric-acid, small. Two sittings, November, 1869. Success perfect.

Case 174.—A gentleman, æt. 64. Mixed calculus, urates, and phosphates. One sitting, greatly relieved; apparently cured, but patient declined further examination. Mr. Clover gave chloroform, summer, 1869.

Case 175.—A gentleman, æt. 35. Large calculus of pure phosphate of lime. Patient had formerly suffered from spinal disease and recovered under the care of Mr. Brodhurst. Four sittings, December, 1869. Success perfect.

Case 176.—A gentleman, æt. 69. Uric acid, medium size. Five sittings, December, 1869. In consultation with Dr. Price Jones, of Surbiton. Success perfect.

Case 177.—A gentleman, æt. 33. From Brussels. Small mixed calculus of peculiar formation, the basis being the triple phosphate with organic matter, mostly fat. Two sittings, December, 1869. There is a tendency at present for this material to reappear; but it is quite controlled by daily washing out the bladder. August, 1870, quite well.

Case 178.—A gentleman, æt. 55. Uric-acid stone, medium size. Four sittings, January, 1870. Success perfect.

Case 179.—A gentleman, æt. 73. Uric-acid, small medium size. Five sittings, January and February, 1870. Seen conjointly with Dr. Smith, of Little Hadham, Herts. Success perfect.

Case 180.—A. R—, æt. 22. University College Hospital. Small oxalate-of-lime calculus. Two sittings, January, 1870. Success perfect.

Case 181.—A gentleman, æt. 49. Uric-acid, small medium size. Five sittings, February, 1870. Seen conjointly with Mr. J. Storey, of London. Success perfect.

Case 182.—A clergyman, æt. 65. University College Hospital. Two uric-acid calculi of medium size. Eight sittings, February and March, 1870. Treatment much delayed by extremely severe attacks of gout. Successful.

Case 183.—A gentleman, æt. 74. Small uric-acid stone. Two sittings, January, 1870. Success perfect. I crushed a large stone for this gentleman a year ago. He was perfectly well until a fortnight ago, when he had violent vomiting and pain in the back, announcing the descent of a fresh uric-acid calculus, about the size of a bean. Success perfect.

Case 184.—W. H—, æt. 57. University College Hospital. Uric-acid stone of medium size. Five sittings, spring, 1870. Success perfect.

ON

SUPRA-CONDYLOID AMPUTATION OF THE THIGH.

BY

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Received May 10th.—Read May 24th, 1870.

In all cases in which, from either disease or accident, it is deemed advisable to amputate through the knee, or at some point above but near that joint, two questions of prime importance must always present themselves for consideration to the operating surgeon. The first of these is to determine which operation is attended with least risk to the patient; and the second, which is the best kind of stump for the subsequent adaptation of an artificial limb. As regards the first of these questions, it cannot be denied that, although the introduction into surgical practice of knee amputations is of comparatively recent date, the weight of all generally acknowledged surgical authorities who are or have been engaged in civil practice, and who have had opportunity of practically testing the value of this operation, is in favour of the amputation at the knee-joint. The main objects of this paper are to point out the advantages of amputation at the knee and, finally, to discuss a modification of Gritti's method, which I

have ventured to term the "supra-condyloid amputation of the thigh," and which, although I have only performed it twice on the living subject, seems to me to retain the advantages of the various modes of amputating at the knee, and to get rid of their supposed disadvantages if not entirely, at least to a very great extent.

It is now little more than forty years since amputation at the knee, previously recommended and practised by Petit, Brasdor, and Hoin, was, after a period in which it fell into disuse, revived by the late Professor Velpeau. In his paper, published in 1830, he gives a brief account of nine cases which had been recorded by these surgeons. Of these, one only terminated unsuccessfully. From the results obtained by his predecessors, as well as by himself, Professor Velpeau, in a rather lengthy paper, deals with the various advantages of this procedure, which may be briefly epitomised as follows:

I. That the belief in the risk of exposing large cartilaginous surfaces is proved to be imaginary.

II. That after amputation at the knee the weight of the body can be placed on the face of the stump; whereas in all amputations nearer the trunk the support must be at the tuberosity of the ischium.

III. That after amputation at the knee the hip-joint preserves all its movements, and the patient need not walk as if that joint were anchyloid, as he must do after amputation of the thigh.

IV. That the shock is not great, as the wound is almost entirely confined to the integuments, and no muscles of great bulk are divided.

V. That only one artery of any considerable size requires deligation after this mode of amputation.

Fifteen years subsequently, in 1845, Prof. Syme, notwithstanding the rash and indiscriminate proscription of Velpeau's operations (which were stigmatised in one of the leading surgical journals as "experimental murders"), introduced a modification of Velpeau's circular amputation at the knee, this modification consisting in sawing through the condyles

and taking a long flap from the calf of the leg. The great advantages of this procedure are, that the medullary canal is not opened, that the amputation is further removed from the trunk, and also that there is less risk of the formation of the tubular sequestra, which not unfrequently occur after amputation of the thigh, and which result in Mr. Syme's opinion, from injury to the medullary membrane or division of the nutritious artery or arteries. This operation, which appears to be identical with Hoin's, Mr. Syme subsequently abandoned in favour of Mr. Carden's method.

It is hardly necessary to cite authorities to prove that amputation through or in immediate proximity to the knee-joint, is a less hazardous procedure than amputation of the thigh. The researches of Mr. Pollock, Dr. McCormac, Dr. Brinton, and others, sufficiently attest this fact.

Cruveilhier is of opinion that the non-interference with the medullary canal obviates many of the dangers of amputation, and Malgaigne states that when the surgeon has the choice, the amputation at the knee merits "toute préférence sur l'amputation de la cuisse dans la continuité." Dr. Thomas Markoe, in a classical paper on this subject, published in the 'New York Journal of Medicine' for January, 1856, thus expresses himself:—"The stump left after operation at the knee, if it be a good one, is perfectly capable of sustaining the pressure of the body on a simple cushion. This fact is fully demonstrated by the cases published both here and abroad. To the poor man this single circumstance makes all the difference between his being able to earn his living by active employment and his being laid up for life a hopeless cripple. To the rich man, who is able to secure the aid of an artificial limb, it makes the difference between a point of support at the knee and a point of support at the ischium. In fact, it is practically the difference between amputation below and amputation above the knee."

Lastly, I may mention that Prof. Syme has remarked that he feels assured that amputation at the knee will, when its performance is possible, "supersede amputation of the thigh,

which, notwithstanding all the attempts to improve it, has so long remained an opprobrium of surgery."

Were it necessary I might adduce many more opinions of eminent operating surgeons in favour of the amputation through or close to the knee-joint. But, in truth, after the able paper recently read before this Society by Mr. Pollock, this is hardly required.

It is worth while to consider the principal objection which orthopædic mechanists make to such amputations. I have spoken to several of them, and it is certainly of importance to know that there is a great uniformity of opinion among them, which is that, for the subsequent adaptation of an artificial leg, the stump after amputation at the knee is inconveniently long. Mr. Heather Bigg remarks that although the retention of the patella and consequent ability of the patient to take a firm and efficient bearing on the end of the stump offer many advantages, yet they are neutralised by the circumstance that the presence of so long a stump interferes with the shape and artistic beauty of the prothetic mechanism, it being absolutely impossible to give a natural representation of the knee-joint when so large a portion of substance remains to be disposed of. "Again," he says, "from the length of the stump requiring a resting surface, that surface would project beyond the other limb, on the knee being fixed, giving the wearer an appearance of possessing one leg longer than the other." He, therefore, is of opinion that for amputation above the knee the junction of the lower and middle third of the thigh should, if possible, be selected for the operation.

It appears, however, to me that this objection is hardly one that should deter the surgeon from performing when, it is possible, the less hazardous operation; for I cannot but think that the difficulty of so arranging the appliance, as that on the limb being flexed the concave resting surface should not project beyond the stump, but follow accurately its convexity, would not be wholly insurmountable, even when the amputation is made through the knee-joint. There would be less difficulty when the amputation through the condyles, "the

trans-condylae amputation" (Lücke), is performed; and still less when the amputation above the condyles is selected, in which procedure the thigh can be diminished in length fully one inch or an inch and a quarter.

The operation to which I wish to draw special attention in this paper is a modification of the procedure known in some of the Continental schools as "Gritti's amputation," which is itself a modification of Mr. Carden's amputation at the knee. One great difference between my operation and those practised on the Continent is that the femoral section is made considerably higher up, being fully half or three quarters of an inch above the antero-superior edge of the condyloid cartilage. Having made sections of a large number of femora in this situation, I can confidently state that the bone may be divided as high as I have mentioned, and in some cases even higher, without opening the medullary canal.

In the great majority of cases the medullary canal terminates at a point three quarters of an inch above the cartilage of incrustation on the outside, and over one inch above on the inside, anteriorly. Posteriorly, one half an inch above the articular cartilage on the inside, and more than three quarters of an inch above it on the outside, as the cartilage of incrustation is higher up in front on the outside and higher up posteriorly on the inside.

In all cases, too, the cartilaginous surface of the patella should be removed, the supposed difficulty of which has been in many persons' opinion a great one, but which, in truth, is quite visionary. The advantages to be derived from dividing the bone so high are, first, that this method of operating ensures that the portion of the flap to which the patella is attached shall constitute the face of the stump, there being no danger when the femoral section is made so high of the patella being drawn up during the process of healing on to the anterior surface of the femur, as there is in the operation through the condyles; secondly, that the divided surface of the femur can be kept perfectly and permanently covered by the patella; and, thirdly, that by making the high section the objection I have already alluded to, of the stump being

inconveniently long for the subsequent adaptation of a mechanical appliance, is obviated to a great extent, if not entirely.

In a paper by Dr. Melchiorj, of Salò, on this modification of Carden's operation, a *precis* of which is given in the 'Biennial Retrospect of the Sydenham Society' for 1867–8, the particulars of three cases in which this operation was performed are described, but in only one of them was the articular surface of the patella removed. It would appear, therefore, that much importance was not attached by Gritti to the removal of this portion of the bone. It seems to me, however, that in order to get osseous anchylosis between the patella and femur, it is necessary to remove the posterior surface of the former, as the chances of union between the two bones taking place would otherwise be extremely limited.

The anterior flap, not rectangular but oval, should reach from a point one inch above either condyle to the other, and should extend downwards to the tubercle of the tibia. A posterior flap, at least one third of the length of the anterior one, should also be formed, as the posterior tissues retract so much more than the anterior ones; and therefore, unless a flap in this situation be made, there is much risk of a gaping wound resulting, which would greatly protract the convalescence of the patient. In making the posterior flap, the convexity at its anterior extremity should be directed backwards, so that in subsequently adapting the flaps the convexity at the extremity of the anterior should accurately fit the concavity at the extremity of the posterior flap.

It will be seen, therefore, that the differences between this procedure and the Italian operation are—

First. That the femoral section is made in all cases at least half an inch above the antero-superior edge of the condyloid cartilage.

Second. That in all cases the cartilaginous surface of the patella is removed.

Third. That the flap is oval, not rectangular.

Fourth. That there is a posterior flap fully one third of the length of the anterior flap.

I may now proceed to give as briefly as possible the particulars of the cases in which I performed this operation, and in one of which the amputation was a primary one.

Michael Crow, æt. 32, by occupation a tailor, was admitted into the Richmond Surgical Hospital on the 7th of last January, suffering from extensive carious disease of the bones of the left leg, ankle-joint, and metatarsus. He stated that, about thirteen years previously, while playing at football, he received a kick on the tibia. The leg, he stated, "got sore" immediately, and the disease spread downwards. For more than ten years the disease was localised to the bones of the leg, being confined, namely, to about their middle thirds. The disease then extended downwards, and about a year after the ankle-joint and metatarsal bones became involved.

On his admission into hospital, the patient had a pale anæmic appearance, and was much debilitated from the long continued and extensive disease. The leg, ankle, and foot were much swollen and œdematous, and numerous sinuses existed leading down to softened diseased bone, through which purulent matter, varying as much in consistence as in quantity, continually oozed. Although there were no sinuses or other evidence of disease in the upper extremity of the tibia, I deemed amputation at the knee preferable to that immediately below the tubercle of the tibia, as from the great length of time the disease had lasted I considered it most probable that the bone in its entire extent was involved, a view which a section of the bone made subsequently verified.

On the 18th January I performed the supra-condyloid amputation in the following manner. I commenced by making an incision with a strong scalpel, beginning one inch above the external condyle, and carried it merely through the integument downwards and forwards to the tubercle of the tibia, and then carried it upwards and backwards to a corresponding point on the inner side of the thigh. The knife was then closely applied to the edge of the somewhat contracted integuments, the deeper structures were separated, and the flap containing the patella rapidly dis-

sected back to a point as high as where the incisions were originally commenced. The posterior flap, at least one third in length of the anterior flap, was then made, the first incision, or that through the skin, being so curved that the convexity should look backwards. The deeper structures were then divided with an ordinary amputation knife, and the rest of the posterior flap completed by this instrument. A transverse section of the femur was then made, commencing half an inch above the commencement of the antero-superior edge of the condyloid articular cartilage. The removal of the articular surface of the patella constituted the last stage of the operation, and was not attended with any difficulty. This section I find is most rapidly accomplished with one of the Langenbeck's fine resection saws, the so-called "Stichsäge." Only one vessel, the popliteal artery, required deligation; all other arteries were secured by torsion.

There was considerable hæmorrhage from the popliteal vein, and some delay was occasioned in arresting it. The freshly cut surfaces of both bones were then accurately adjusted, and the edges of both flaps held together by numerous points of interrupted silver wire suture.

It is unnecessary to give the daily progress of the case. Nothing untoward occurred during the convalescence. A better idea than any verbal description I could give of the result, can be gained by an examination of the photograph of the stump, of which a representation is appended (Pl. III). Before dismissing this case, I may mention that the patient has perfect ease and comfort while resting his entire weight on the face of the stump—a result which is never obtained after any other amputation of the thigh, whether it be done by the circular method, the antero-posterior, lateral, oval, or rectangular flap operations.

Primary supra-condyloid amputation.

Michael Kelly, æt. 23, a cabman by occupation, was admitted into the Richmond Surgical Hospital, on Saturday

night, the 19th of February. About ten minutes previous to his admission, whilst driving very rapidly, he attempted to get off the car, and in so doing, while his foot was on the step of the vehicle, the step broke, and the foot passed back, getting between the spokes of the rapidly revolving wheel. The result of this unfortunate accident was, that he sustained an extensive compound comminuted fracture of both bones of the leg. The fibula was fractured in three places, and the tibia, which was broken at about the junction of the middle and lower thirds, was projecting through the soft parts at the inner side of the leg. There was extensive contusion and laceration of the soft parts, which extended as high on the outside of the leg as the head of the fibula. Looking at the numerous fractures that were present, and the great amount of laceration and exposure of the soft tissues, any attempt at saving the limb was obviously hopeless; and also having regard to the fact that the laceration and contusion of the soft parts extended as high as the head of the fibula, I deemed an amputation of the leg at the "place of election" impracticable. I considered, therefore, that, under these circumstances, the supra-condyloid amputation would be the most suitable, and accordingly performed it precisely in the manner I have described in the preceding case. There was in this case, as there generally has been in the primary amputations I have performed, secondary hæmorrhage. It occurred twice. The first time was about half an hour after the operation, and the second on the third day. The first time I was obliged to undo the sutures, and seek for the bleeding vessels, which, I may mention, had in the first instance been apparently effectually secured by torsion. The second time the application of Signoroni's tourniquet for half an hour on the femoral artery had the effect of successfully arresting the bleeding. After this the case progressed most favorably, and, as in the first case, the result was perfectly good.

I may now indicate what I believe to be the advantages of the supra-condyloid amputation over, first, the amputations through the knee-joint with preservation of the patella, those,

namely, of Velpeau, Lane, Blenkins, and Markoe; secondly, the amputation through the condyles, as practised by Syme, Sir W. Ferguson, and others, operations which are closely analogous to, if not identical with, the original operation of Hoin; thirdly, Mr. Carden's operation, and its modification by Gritti; and lastly, the other amputations of the thigh, in which the medullary canal is necessarily opened.

Many of the advantages of this operation are doubtless common to it, and to the amputations suggested originally by Hoin and Velpeau; for instance, the stumps being more useful for progression in consequence of the possibility of making pressure on its extremity, and the patient not being obliged to walk as if he had anchylosis of the hip-joint, as is always the case when the point of support is at the pelvis instead of at the extremity of the stump. The diminished liability to tubular sequestra is another advantage common to all the amputations at the knee-joint. Again, the operation being further removed from the trunk, makes it less hazardous to the patient. The shock is less than in the amputations higher in the thigh, as the muscles which are divided are few in number, and these are divided, not through their thick fleshy bellies, but at their tendinous extremities. The muscular interspaces, in which suppurative inflammation so often occurs after ordinary amputations, not being opened, the chances of this occurring are at all events diminished—a point which Dr. Markoe strongly dwells on. There is less liability also to suppuration, from the fact that the parts divided in making the anterior flap are only skin and fasciæ. In connection with the diminished liability to suppuration, I would also mention here the fact that the posterior surface of the anterior flap in the supra-condyloid amputation is covered with a natural synovial lining.

In Carden's and all other flap amputations in this situation, the posterior surface of this flap contains the obliquely divided open mouths of innumerable arteries, veins, and lymphatics, and large numbers of which have also fenestrated openings in them as well. This peculiarity of

the supra-condyloid amputation must, I am convinced, largely diminish the chances, not only of subsequent exhaustive suppuration, but also of purulent absorption. There is another feature in this operation which I believe must lessen the probability of the pyæmia. Professor Langenbeck has suggested that in amputations of the thigh the cut surface of the bone should, in order to prevent its divided vessels coming in contact with the suppuration in the wound, be covered by a periosteal curtain which, previous to dividing the bone, should be taken from the anterior surface of the femur, commencing about an inch below the point of section. As regards the value of this suggestion for diminishing the mortality of thigh amputations, having only tried it in a very few cases, I am not yet in a position to either verify or disprove Professor Langenbeck's statement on this point. I have, however, tested this plan as well on the human subject as on the lower animals, and the results of my experiments would tend to show the great liability of the periosteal curtain to slough away, and not become adherent to the cut surface of the bone. In the supra-condyloid amputation, however, we have an osseous curtain covering the cut surface of the femur which never yet has been known to slough away, so that if there be any value in Professor Langenbeck's suggestion the supra-condyloid amputation must have this among its other advantages. The preservation of the portion of the patella, to which the tendon of this powerful extensor of the thigh is attached, has, however, other obvious advantages. These are the increased power of extending the thigh in progression, and rendering the formation of a conical stump impossible. If the section of the patella be not made these advantages do not exist. In the first place because the elevated ridge dividing the posterior surface of the bone into two unequal portions effectually prevents the divided surface of the femur and patella being in perfect contact. Again, unless osseous anchylosis takes place, there can be no standpoint or firm point of fixation for the extensors to work on; and, lastly, there will always be liability to exfoliation or necrosis of the cartilage of the patella.

Lastly, there is an advantage in the supra-condyloid operation which is possessed by the ordinary circular method of amputation, and which, among other reasons, makes so many surgeons, myself among the number, in amputations of the arm and thigh cling to the circular method in preference to the ordinary flap operations, and that advantage is that the vessels are divided at right angles to their continuity, and not obliquely as they are in all flap operations, which must render these vessels more liable to take on inflammatory action from the wounds in them being necessarily so much greater in extent. I think, therefore, I may fairly claim for the operation which has been the subject of this communication, among other advantages that I have already mentioned, those of both the circular and flap amputations and the defects of neither.

DESCRIPTION OF PLATE III.

Michael Crow, æt. 32, tailor. Case of supra-condyloid amputation of the thigh for extensive carious disease of the bones of the left leg, ankle-joint, and metatarsus.

G H Ford

W West imp

A CASE

OF

EXTROVERSION OF THE BLADDER IN A FEMALE

TREATED BY OPERATION.

BY

EDWARD BARKER,

SURGEON TO THE MELBOURNE HOSPITAL, AND LECTURER ON SURGERY IN THE UNIVERSITY.

COMMUNICATED BY

T. HOLMES, F.R.C.S.

Received June 14th.—Read June 28th, 1870.

J. O. S—, æt. 17, a native of the colony, a dressmaker, was admitted into the Melbourne Hospital on the 7th August, 1868, suffering from congenital extroversion of the bladder. Her general appearance was healthy, with an inclination to stoutness, and she was rather below the average height.

On examination the following conditions presented themselves. The posterior portion of the bladder projected in the form of a round red tumour, larger than a walnut, covered with mucous membrane, in which the orifices of the ureters

could be seen discharging urine. Just below the tumour was a circular orifice about the size of a sixpence, and on introducing the little finger into it, the uterus could be felt about half an inch from the surface.

The clitoris was cleft: there were large excoriations about the groins and between the nates. There were no labia majora and no umbilicus. The horizontal rami of the pubes were wanting. (See Plate IV, fig. 1.) She had menstruated regularly but scantily.

After she had been made fully aware of the uncertainty which attended the experiment to afford her relief, she warmly urged that an attempt should be made. Accordingly, on the 1st October, after she had been brought under the influence of chloroform, I commenced to operate by dissecting off the skin from two opposite portions of the abdominal walls, each about one inch broad and three inches long, on either side the protruded bladder, beginning a little above the position of Poupart's ligament, and two and a half inches from the linea alba. Folds of the integuments on each side were pinched up and a handled needle passed through from about one inch beyond the external limit of denudation and coming out just in the inner boundary, then entering the opposite denuded band and passing out as it first entered, about an inch from the external limit; this needle was then threaded with iron wire and withdrawn. Three of these sutures were made and fastened to the clamp used by Mr. Hutchinson for lacerated perineum.

The superficial parts were brought together by interrupted horsehair sutures. Deep incisions were then made through the integuments outside the clamps, and the parts were dissected upwards and a little inwards to relieve tension. Strips of adhesive plaster were then passed from one side to the other, and the whole was covered over with lint soaked in diluted sulphurous acid. She was then put into bed in a sitting posture, and a silver tube was passed from below upwards under the band of integument covering the bladder, and kept there to prevent any accumulation of urine, and an opiate was administered. She suffered a little sickness the

next day from the effects of the chloroform; she did not have any more pain than might have been expected. Everything went on favorably, and the deep sutures were removed on the fourth day, when the parts appeared to have become firmly united. There was no irritation from the superficial sutures, which were allowed to remain for several days longer.

On the 23rd of October she had an attack of pneumonia, which lasted for a few days, but her health was not sufficiently established until the 19th of November, when I proceeded with the second portion of the operation by denuding as before opposite bands of the abdominal walls two inches in length, commencing about three quarters of an inch above the top of the united flaps and inclining inwards towards the median line; these were brought together and treated as before; they united very well with the exception of one point just above the middle suture, which suppurated and left a fistulous opening.

I did not do anything further until the 14th of March, 1869, as I wished the parts to get as consolidated as possible, there being no hurry, as no urine flowed over the cicatrices or about the parts previously excoriated, and as she was able to continue wearing the tube.

It is also desirable, in all cases, to avoid operating during the heat of summer in this colony, unless it is urgently required.

The third portion of the operation consisted in closing the interval between the pairs of lateral flaps, which was done by denuding a part on each side between the bands resulting from the first and second operations and bringing them together with one deep and two superficial sutures. The opening left above the uppermost band was roofed in by denuding the upper edge of the flaps and part of the adjacent abdominal walls transversely, and joining them by sutures; they fortunately united, and I closed the fistulous opening before mentioned with the actual cautery.

July 4th.—She has been out of the hospital for several weeks, walks about and attends to her business, and can

retain her urine with tolerable ease for two hours whilst recumbent. She continues wearing the silver tube, and an india-rubber urinal when walking about. (See Plate IV, fig. 2.)

DESCRIPTION OF PLATE IV.

Case of Extroversion of the Bladder in a Female treated by Operation.

Fig. 1.— State of the parts before operation.
Fig. 2.— Ditto after operation.

Fig 1.

Fig 2

G H. Ford W West imp

ON

ADENOID VEGETATIONS

IN THE

NASO-PHARYNGEAL CAVITY:

THEIR

PATHOLOGY, DIAGNOSIS, AND TREATMENT.

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Received October 18th.—Read November 23rd, 1869.

Among the permanent defects of speech there is one that claims attention, not only on account of its rather common occurrence—at least, with us in Denmark—but also on account of its frequent coincidence with a very marked defect of hearing. At a superficial glance this condition resembles a chronic cold; patients thus affected, being unable to pronounce the nasal sounds *m* or *n*, will say "cobbod" instead of "common," "doze" or "loze" instead of "nose," "sogg" for "song," &c.; and, being likewise unable to breathe through the nose, they are compelled to keep the

mouth continually open. A closer examination, however, will soon show the difference—unless, indeed, there actually exists the complication of a chronic cold in the head. In the first place, then, the voice is singularly wanting in resonance, and as the nasal consonants cannot be pronounced, the speech sounds short, stuffed, "dead," as I would propose to call it, which is very characteristic and unmistakeable. Then (although the mouth is kept open all the time) the patients often have a peculiar way of twisting and pouting their lips, toying with them, as it were, which adds greatly to the vacancy and stupidity of their look and countenance. The aspect of the nose differs, also, materially from that which we are accustomed to see in chronic colds of the head; for, instead of swelling and redness in and around the nostrils, we here find the nose thinned, flattened from side to side, and the nostrils collapsed and narrow on account of their long inactivity. The secretion of the Schneiderian membrane is often deficient.

Other symptoms requiring to be mentioned are a feeling of fulness in the upper part of the throat, resembling a foreign body behind the posterior nares. Sometimes patients on awaking in the morning discover some blood in the mouth; but oftener there is a copious secretion of a thick greenish or greyish mucus from the upper part of the throat, which may occasionally be seen gliding slowly down the posterior wall of the pharynx, and causing the patient to clear his throat frequently and violently.

The defect of hearing, which so often accompanies the "dead" pronunciation, is of great interest. In fact, very few patients affected with this peculiar way of speaking will be found who, although their hearing may appear normal for the time being, have not occasionally been troubled with tinnitus aurium and deafness, especially after taking cold. But frequently the accompanying defect of hearing is of a more serious and lasting character, viz. chronic catarrh of the tympanum, chronic discharge from the ears, or very troublesome and continual noises. The best opportunity, then, for observing this peculiar defect of speech will be among

ear patients. I have no doubt that a number of my colleagues have likewise observed such cases, and after successfully removing the swelling of the mucous membrane of the nose and throat, supposed to be the evident seat of the mischief, have been rather astonished to find that, after all, the speech was as bad as ever. The patient, tired of the protracted, often painful and still unsuccessful treatment, discontinues his attendance, and resigns himself to his malady. An instance of this kind led me to discover the true seat of the complaint. I had cleared the obstructed passage through the nose, removed the enlarged tonsils and the swelling of the throat and soft palate, but the manner of speaking remained as deficient as ever. The patient, a young lady, now underwent a regular course of training in pronunciation, but with no better result. She then came to me again. Having found rhinoscopy impracticable, I now passed my forefinger behind the soft palate up into the so-called "naso-pharyngeal cavity," and was very much astonished to find this almost entirely filled up by *soft masses*, which, giving way to the finger, felt very much like a bunch of earthworms, and, hanging down from the roof of the pharynx, completely closed up the posterior nares. There was rather free bleeding during and for some minutes after this digital examination. These growths were quite new to me then, and I found no allusion made to them in any of the ancient or modern works on Surgery and Morbid Anatomy which I consulted. The symptoms before enumerated could undoubtedly be accounted for by the presence of the growths, but whether these were the real and only cause remained to be proved by their removal. After some fruitless attempts I at length succeeded in this by an operation which I shall presently describe. The result was most satisfactory; the voice became clear almost immediately, and the patient was able to breathe freely through the nose. Up to this day, eighteen months after the operation, she continues well both as to speech and breathing.

I have since, in a great number of cases, explored the naso-pharyngeal cavity, and whenever the peculiar deadness

of pronunciation occurred these growths were *invariably* met with. All the operations on these cases but one had the desired curative effect.

These unhealthy *vegetations*, then, require our serious attention, for, apart from subtracting materially from the good looks of the patient and forming an impediment to speech, they at the same time endanger the important organ of hearing. They may spring from any part of the *naso-pharyngeal cavity*, the septum narium only excepted. Here, at least, I have never observed them. In number, size, and character, they show considerable difference. Cases like the one above mentioned, where the whole cavity was stuffed with them and the posterior nostrils were closed, are exceptional.

Regarding their shape, they are best divided into three forms, viz. the *cristate*, the *cylindrical*, and the *flat* form; and each of these, again, may be found to be either soft or hard, their physical character varying with the locality from which they spring.

The posterior and superior walls of the naso-pharyngeal cavity appear to be their place of election, and in both places they generally assume the shape of soft and brittle cristæ or folds of different height, rounded off at their edges, and bleeding readily. On the posterior walls their direction is perpendicular, but it is transverse on the superior wall of the cavity, where they lean against the upper part of the septum. In a few cases the greater part of the so-called fornix, or upper curved part of the posterior wall of the pharynx, where the *pharyngeal tonsil* is situated, has been found occupied by a round and solid, but brittle elevation, varying in thickness, and formed of these same vegetations. Their perpendicular folds mostly cover the whole width of the fornix, and are often so closely packed together that they seem to form one compact but soft mass. At other times they are few in number, and can easily be separated from each other. And lastly, I have observed some cases where, the fornix being quite covered by them, the middle folds protruded to such an extent as to divide the cavity into two lateral hollows, forming, as it were, a septum extending from the upper wall

of the cavity nearly down to the arch of the atlas. Growths of a cylindrical shape are occasionally found on the fornix, but less frequently than the cristate form. They are not so soft as the latter, their surface is smooth, and their pendulous ends are sometimes club-shaped. At other times, again, they have a broad base, and are of a hemispherical shape. Finally, it is to be observed that, in case of the vegetations on this spot being numerous, the lower, more perpendicular part of the posterior wall, is found covered occasionally with soft, cushion-shaped, irregularly situated growths.

On the *lateral* walls of the pharynx the vegetations are generally grouped around the apertures of the Eustachian tubes, and here the cylindrical form prevails. Their quantity is often considerable, their texture hard, their surface polished and at times slightly undulated; they are either pointed or blunt at their extremity, but shorter, as a rule, than the cylindrical growths on the fornix. On the side walls the cristate form also is not unfrequently found. Attached vertically, these growths often cross the cartilage of the tube. They spring from a large base, their sides join in a sharp edge, and they are of considerable hardness. I have in some cases been able to trace their course behind the posterior pillars of the fauces down to the level of the proper tonsils. On the sides of the cavity these growths sometimes appear in the shape of round spots of almost gristly hardness, and their situation appears to be confined to the inner wall of the Eustachian tubes. The growths occurring on the side walls generally differ in this also from those situated on the fornix and upper wall, that they are firmer and not so apt to bleed so freely on being examined with the finger. On the upper surface of the *soft palate* I have only in a few instances noticed any vegetations, but occasionally I have observed a thin resistant fold springing from the posterior edge of the floor of the nares, and stretching backwards for some distance, forming, as it were, a duplicature of the soft palate. In a few other cases I saw round and hard spots on the velum, similar to those sometimes observed on the lateral walls.

The *colour* of these vegetations does not differ materially

from that of the surrounding mucous membrane, which is invariably in a state of congestion. Sometimes they present a yellowish hue. The aspect of their *surface* is generally smooth, either quite shining or velvet-like, but sometimes showing indentations and incisions of different length and direction, causing corresponding prominences, which occasionally look like small bunches of grapes. This state, however, is only observed in the larger cristate vegetations.

In conclusion, it may be stated that the fornix is the locality where the growths are most frequently found; in fact, it is rare to meet with them on other parts, the side walls, for instance, without simultaneously observing them on the posterior wall.

The structure of the vegetations.—The surface of a section of a recent specimen is generally smooth, and shows no laminæ or divisions in the tissue. Frequently small, round, yellowish spots may be seen, or cup-like depressions, varying in size, but always small. The juice pressed out of the section is mostly inconsiderable; it is transparent, and contains innumerable lymph-corpuscles. In fine sections of specimens hardened in alcohol or dilute solutions of chromic acid, the light-coloured round spots are much more distinct. The spots themselves are sometimes pierced by a hole varying from the size of the point of a pin to 1—1½ mm. diameter, or they are absent altogether, whilst holes of the same dimensions as the spots take their place.

In preparations gently brushed with a sable-hair brush, and then tinged with carmine, a very transparent delicate network is seen, the meshes of which either contain more or fewer lymph-cells or are entirely empty where the brush has swept these out. In other growths, especially in those of the side-walls, the threads of the network are coarser and the meshes smaller; these growths were further distinguished by the appearance of genuine and sometimes rather firm areolar tissue. The little perforations above mentioned are the cavities of normal or enlarged follicles, from the compact capsule of which the network extends more or less into the cavity, growing more delicate as it proceeds inwards. The

excretory ducts of aciniform glands are also seen in great number, being easily recognised by their beautiful epithelial lining. Most specimens are extremely vascular, containing arteries, capillaries, and, still more, veins, as distinguishable by the direction and character of their parietal nuclei. Some growths even, especially those of the posterior wall, seem to be made up almost exclusively of blood-vessels, between the numerous ramifications of which a scanty areolar network containing lymph-cells is interspersed. The connection between the meshes and the outer areolar coat or perivascular areolar tissue of the blood-vessels can often be easily perceived. The epithelium covering the vegetations is sometimes ciliated, showing wonderfully distinct cilia, and sometimes of the pavement form, composed of very large cells. In some specimens both forms are met with, either separated from each other by a well-marked line or by some transitory epithelial cell-forms. Thus, the microscopical characters may, in a certain degree, point out the spot from which the growth had sprung. Sometimes the follicles are so near the surface that only a very delicate lining membrane exists between their walls and the epithelium.

The microscopic characters of these growths establish their identity with the closed follicles of the mucous membrane from which they arise, the relative quantity of blood-vessels and the presence of real areolar tissue forming an immaterial difference between them. The most prominent structural character of these growths as well as that of the mucous lining of the naso-pharyngeal cavity being adenoid, I propose to designate the former "*adenoid vegetations*." The occurrence of free excrescences composed of the same tissues as lymphatic glands may appear very remarkable, but the fact is certain. Concerning the vegetations on the posterior and superior pharyngeal walls, there can be no doubt as to their constituting an hypertrophied condition of the *pharyngeal tonsil* of the adjacent mucous membrane lining the roof of the cavity. Why the vegetations on the lateral walls and on the upper surface of the soft palate should assume their peculiar shape may be difficult to ex-

plain. That the growths on the posterior walls never, or only in their pedicles, contain traces of areolar tissue, while this seems to be constantly present in those springing from the lateral walls, depends on the comparative thickness of the adenoid structures of the former part.

Simple hypertrophy of the adenoid layer of the pharynx, without the formation of vegetations, may exist, as, for example, in the recessus or sinus faucium laterales, which are then filled up by the same brittle structure, and seem to be altogether absent.

When these adenoid vegetations are present the *surrounding mucous membrane* is often in a morbid condition. Thus, the mucous lining of the posterior wall of the oral part of the pharynx is often swollen or is covered with enlarged follicles or with vertical folds, or exhibits the granular condition known as pharyngitis granulosa. The granulations found in this latter disease vary in size, and the largest sometimes resemble in shape and consistence those soft cushion-like excrescences which I mentioned as occurring in the lower part of the posterior wall of the naso-pharyngeal cavity. The pharyngeal granulations have recently been examined by R. Wagner,[1] and have been found to be also composed of adenoid tissue. Consequently the cushion-like vegetations may be considered as transitory forms between the larger excrescences and the granulations of the visible part of the pharynx.

In these cases the *tonsils* are often in a state of chronic enlargement and more or less hardened.

The *soft palate* and its arches are frequently thickened, approximated to the posterior wall of the fauces, and deficient in mobility.

Lastly, the mucous lining of the *nasal* cavity is found in many cases swollen and reddish, although in extreme cases its secretion is decidedly deficient.

These morbid conditions of the mucous membrane, however, are necessary concomitants or sequelæ of adenoid vegetations, and *vice versâ*. Still, it is rare to find the fauces and nares in a normal state when great numbers of vegeta-

[1] Wagner's 'Archiv d. Heilkunde,' 6 jahrg., 1865, p. 318.

tions exist, showing that the latter are, at least in some measure, due to the same influences which give rise to a chronic inflammatory state of the whole superior portion of the respiratory passages.

Symptoms.—It is obvious that the symptoms caused by the presence of adenoid vegetations must vary according to the number and size of these as well as to the locality in which they are situated. If they are few in number and small, the symptoms may be wanting entirely; if, on the other hand, the growths are so exuberant as to completely close up the air-passage through the nose, the symptoms are marked. The patient will be compelled to keep the mouth open, the nose thereby gradually collapsing and growing thin; the pronunciation will assume the "dead" character, for the voice loses its resonance in the naso-pharyngeal cavity, and it is perfectly impossible to pronounce clearly the nasal sounds. Finally, the expansion of the growths may cause the sensation of a foreign body behind the posterior nares.

But it is not only, nor even principally, upon the bulk and number of the growths that the intensity and extent of the above-described symptoms depend, for their *situation* is of greater importance. If they are only sufficiently large and so situated as to prevent the play of the soft palate during speech, the pronunciation of nasal sounds will be impeded, and breathing through the nose be difficult. Nay, even small vegetations on the lower part of the posterior wall of the cavity opposite to the atlas will sometimes cause faulty pronunciation of a single letter, only observable, perhaps, to a practised ear, and will compel such persons, when not in the act of speaking, to open their mouth more or less frequently, because the normal air-passage is insufficient. In such cases the symptoms, of course, will be more conspicuous when a supervening cold causes the mucous membrane to swell.

The adenoid vegetations keeping the surrounding mucous membrane in a state of chronic swelling—owing to their vascularity—it will not excite surprise that growths situated around the apertures of the Eustachian tubes should be so

very apt to cause hypertrophy and over-secretion of the mucous membrane of those canals. The swelling, perhaps slight and variable at first, gradually increases, becomes habitual, and once propagated to the tympanum will, after some time, cause either a chronic adhesive inflammation of this cavity or a more acute one, when the secretion from the tympanum, being prevented from escaping into the pharynx, will give rise to a purulent inflammation of the middle ear, usually followed by a perforation of the membrana tympani.

It must be stated, however, that the latter form of inflammation occurs much more rarely in connection with adenoid vegetations than the chronic catarrh; and regarding this catarrh, which the late Mr. Toynbee has proved to be one of the most frequent causes of deafness, I am convinced by experience that it is often due to the presence of adenoid growths around the guttural apertures of the Eustachian tubes. Hence, in a chronic catarrh of the tympanum an attentive exploration of the naso-pharyngeal cavity should never be omitted, as the presence of vegetations will materially influence the prognosis and treatment of the disease. This form of deafness will grow worse, even by a slight cold. As long as this affection is not inveterate, the use of the Eustachian catheter will often produce a sudden improvement in the hearing, but unfortunately this is soon followed by a relapse, as the exciting cause of the over-secretion still remains.

Two symptoms may here be mentioned which frequently accompany the use of the ear catheter, and which may almost be called pathognomonic, viz. (1) the stream of air, after having passed freely into the tympanic cavity—as proved by auscultation—will suddenly stop, and after a little while flow on without any obvious reason as freely as before; (2) a gurgling or bubbling sound of thick mucus behind the nasal cavity is heard during insufflation, and sometimes bubbles of the same viscid mucus will appear at the nostril through which the catheter has been introduced. After the removal of the vegetations both these symptoms invariably

disappear, and in one very inveterate case I have even observed a perforation in the membrana tympani to heal up. As vegetations on the lateral walls are not observed without their simultaneous and still more exuberant appearance on the posterior wall, the deafness in such cases will, of course, be mostly found complicated by the above-described defects of speech and respiration. The general rule may be, therefore, laid down, that *a deaf patient who breathes through the mouth and has a thin compressed nose is affected with vegetations in the naso-pharyngeal cavity*, and to confirm this we do not even require to notice the speech.

Apart from the quantity, size, and situation of the vegetations, their consistence is not without some influence on the symptoms. Soft vegetations are more liable to bleed than harder ones, the patient consequently will oftener, on awaking from sleep, *find blood in the mouth*. To this peculiar symptom I have directed attention before. The blood may vary in quantity; it may be pure and fluid, or coagulated, or mixed with mucus; it may be observed regularly or at long intervals; its occurrence is apt to puzzle the medical attendant if he does not know its proper source; and it may be attributed to some more serious cause, especially as the patients are often strumous.

Diagnosis.—The preceding description will suffice to establish the diagnosis of many, especially uncomplicated cases of adenoid vegetations. But, as already stated, such cases are not frequent, the adjacent mucous membrane of the nose and throat being mostly affected at the same time by swelling and increased secretion. The best known and most frequently met with condition, producing symptoms similar to those of adenoid growths, is simple *swelling of the mucous membrane of the nose*. Now, if this be acute, it will soon disappear, either of itself or after some treatment, and then the speech and breathing will be normal as before. But if it be chronic, the resemblance may sometimes become permanent, and will be very striking. It is rare, however, to find the air-passage through the nares entirely and lastingly interrupted, unless polypus be present, and of such a size,

moreover, that it would be easily discovered. An accustomed ear will, in such cases at all events, easily perceive that the speech, difficult as it may be, is more sonorous than when the naso-pharyngeal cavity is encroached upon by adenoid vegetations, those cases, of course, being excepted in which the two diseases complicate each other. Moreover, as already mentioned, the secretion from the mucous membrane of the nose is often wanting when the vegetations obstruct the passage behind; its return, therefore, after the removal of the growths, may have some diagnostic value in certain doubtful cases.

If the *tonsils* are much enlarged, the speech will be dull and thick, but this cannot be easily mistaken for the "dead" pronunciation accompanying adenoid vegetations. Moreover, the presence of enlarged tonsils alone does not, as a rule, impede the respiration through the nose. In those cases only where the tonsils have grown so large as to press back the posterior arches of the soft palate, thereby obstructing the Eustachian tubes, will the diagnosis become difficult. The best way for removing doubt in such cases—which are rare, and mostly complicated by adenoid vegetations—is to excise the tonsils. If, after this operation, the breathing, speech, and hearing should not be restored to their normal state, there must exist some complication, and further examination is necessary.

The greatest difficulty in diagnosis is experienced in those cases where the *soft palate* has, by chronic inflammation, been thickened to such a degree that there is hardly any space left between it and the posterior wall of the pharynx, the mucous lining of which is also generally found swollen in such cases. By the researches of Passavant[1] it has been shown that during the pronunciation of any letter, nasal sounds only excepted, the veil of the palate is raised, and with its superior and more horizontal part meets the posterior wall of the pharynx, which on its side is drawn forward, in a zone opposite the soft palate, by the superior constrictor of the pharynx, which muscle Passavant supposes to be

[1] 'Ueber die Verschliessung des Schlundes beim Sprechen,' 1863.

chiefly used for the purposes of pronunciation. We may, therefore, suppose that in such cases of swelling of the soft palate, and even when in speaking and *breathing* this part and the pharynx do not quite meet, the expired air will nevertheless find difficulty in escaping through the nose; that consequently the resonance of the voice in the naso-pharyngeal cavity will be more or less lost, and that the speech will assume a character resembling that described as "dead." The diagnosis, accordingly, may be doubtful. The only case, indeed, of "dead" pronunciation observed by me, in which the removal of the vegetations was not followed by improvement of the speech, was just one of the kind described, viz. a combination of adenoid growths with swelling of the soft palate, the latter persisting obstinately after the removal of the former.[1] In similar instances, and in those likewise where *no symptoms* of vegetations are observed, but the patient suffers from a disease of the ear, and it is thought of importance to ascertain the presence or absence of vegetations, *physical means of diagnosis* must be had recourse to.

Two means of investigation are here available, viz. rhinoscopy and digital examination. The former, besides requiring special practice and experience, is often difficult, or even impracticable, owing chiefly "to the length and breadth of the uvula, and to the too short a distance between the anterior pillar of the fauces and the posterior wall of the pharynx. In a certain number of cases it is quite impossible to practise rhinoscopy, and it is generally easy, by examining the fauces, and observing whether this space exists to tell beforehand whether an inspection of the nasal fossæ is possible."[2]

To the above-mentioned general obstacles to rhinoscopy

[1] By way of proving that in this case the swelling of the soft palate was the reason of the faulty pronunciation of the nasal sounds, I passed a thread through each nostril, bringing them out by the mouth and joining the ends in front. By now drawing the threads forward, thereby raising the soft palate towards the hard palate, the patient was able to pronounce *m* and *n* well.

[2] Mackenzie, 'The Use of the Laryngoscope in Diseases of the Throat, with an Appendix on Rhinoscopy,' p. 148. London, 1865.

must be added, that due to the morbid irritability of the whole fauces.

Now, this morbid irritability, as well as the very short distance between the anterior pillars and the posterior wall of the fauces, caused by the swelling of these parts, are observed exceedingly often, and to a high degree, in cases of adenoid vegetations in the naso-pharyngeal cavity. Moreover, a good view of the cavity cannot, in many cases, be obtained, owing to the vegetations themselves. Their normal seat being the upper and posterior wall of the pharynx, they are only visible in a foreshortened way, not favorable to the discovery of details. The soft folds, of which vegetations on that spot are generally composed, are mostly situated in one plane, and so closely packed together that an approximate estimate of the shape and depth of the folds can only be arrived at by introducing a probe through the nose during examination, and gently parting the vegetations. If the naso-pharyngeal cavity be quite filled by vegetations, the use of the rhinoscope is wholly precluded. If a piece of tape be made to pass through the nose and mouth, and be tied in front of the upper lip, a noose is formed around the soft palate, and by drawing this forward the view into the naso-pharyngeal cavity during rhinoscopy is sometimes much facilitated.

When, however, the vegetations are situated on the side walls, especially when they belong to the cylindrical form, the rhinoscope enables us to study them fully. Unfortunately, vegetations on the side walls are, as a rule, accompanied by a still greater number of growths on the posterior wall.

That rhinoscopy is an insufficient means of examination in this disease is probably to be inferred from the fact that, as far as I have been able to ascertain, we only possess the description of five cases of diseases of the naso-pharyngeal cavity which could be interpreted as cases of adenoid vegetations. Two of these have been observed by Voltolini in Breslau,[1] who has also published several other excellent

[1] 'Die Anwendung der Galvanocaustik im Innern des Kehlkopfes u. Schlundkopfes,' p. 66, seqq. Wien, 1867.

treatises on rhinoscopy. In both those cases Voltolini noticed cylindrical growths in the naso-pharyngeal cavity, situated in the first case on the roof and the side walls, and in the other spread over the whole surface of the cavity, thereby partly filling it, and having broad bases. In the latter case they were also seen on the posterior surfaces of the pharyngo-palatine arches, a situation in which I never detected them. In the first case mention is only made of the deafness of the patient, but in the second there was observed a series of very marked symptoms of the before-described character. In both cases the galvanic cautery was employed by Voltolini with success.

The remaining three observations are by Dr. Benno Löwenberg, of Paris.[1] His description of these cases is very exact. In two of them there were only cylindrical vegetations spreading over a large portion of the naso-pharyngeal cavity; in the third, cristate growths hanging down from the roof of the cavity were likewise observed. The author describes these growths under the title of "Pharyngitis granulosa," and they were accompanied by very well-marked granulations on the posterior wall of the pharynx. No mention is made of any symptom or treatment.

It must not be supposed that by the above remarks I in any way mean to detract from the value of the rhinoscope in general, or as a means for ascertaining the presence of adenoid growths. For it has proved very useful to myself, not only before operation in cases favorable to its introduction, but also, and principally, after operation (when the pharynx is less irritable and the cavity much more accessible to observation), in order to see how far this had been successful and if any remnants of the growth remained. Rhinoscopy must not, however, be considered as the sole or most convenient mode of examination in cases of adenoid vegetations. Its use is limited, it requires considerable practice, and the

[1] "Die Verwerthung der Rhinoskopie und der Nasenschlunddouche für Erkennung u. Behandlung der Krankheiten des Ohres u. des Nasenrachenraumes," 'Archiv fur Ohrenheilkunde von Tröltsch, Politzer u. Schwartze,' vol. ii, pp. 116 and 117.

results obtained by it are often insufficient for a correct diagnosis of the disease in question.

A digital examination of the parts must, therefore, be superadded; and, indeed, as a general mode of investigation in cases of vegetations, this latter is preferable to rhinoscopy, for it is available under all circumstances, without either requiring practice on the part of the surgeon or preparatory training on the part of the patient; it even succeeds well in children; it reveals with sufficient clearness the number, situation, shape, size, and consistence of the vegetations; lastly, in rendering the pharynx more tolerant, it acts as a good preparation for the operation and for future inspection with the rhinoscope.

The digital examination of the naso-pharyngeal cavity should not be protracted longer than is consistent with the necessary exactness, so as to spare the patient the nausea it is liable to produce. But if it cannot be accomplished quickly, the nausea may be prevented by making the patient breathe deeply and regularly through the mouth during the examination. This examination should also be very gently performed, in order to prevent the bleeding which readily occurs when vegetations are present; besides this, rough handling is apt in nervous persons to be followed by some pain in the back part of the head. The patient being seated on a chair, and the surgeon standing in front and fixing the head with one hand, the index finger of the other hand is cautiously passed over the tongue to the margin of the soft palate. At this point it will generally be arrested for a little while by a spasmodic contraction of the soft palate, but presently, by gentle lateral movements, the finger will succeed in passing by one of the sides of the uvula, and then it easily glides up behind the velum. The finger will now not only detect any unevenness on the posterior surface of the velum, but also any projections on the lower part of the fornix. It is next passed up along the posterior edge of the septum, so as to remain in front of any vegetations situated on the roof of the cavity which press against the upper part of the septum. Then, after having felt around in the posterior nares, where the

lower turbinated bone sometimes comes in contact with the finger, this is turned back to the posterior pharyngeal wall, which, as the place where the vegetations are most frequently met with, requires very careful examination. The finger must here be turned on its side in order to enter into any crevices between the growths, the folds of which, if present, may be counted, their length and thickness ascertained, and their consistence tested by gentle pressure.

Sometimes, in doubtful cases, a slightly curved probe may be passed through the nose to bring the individual vegetations into close contact with the finger. The finger, still held sideways, may be passed next down into the sinus or recessus lateralis, which even in children is of sufficient width to permit of this. Finally, the examination on this side is completed by noting accurately the state of the lateral walls of this cavity. Here the condition of the pharyngeal apertures of the Eustachian tube can be felt, as well as any unevenness in the immediate neighbourhood of the opening. The other side of the pharynx must then be examined in the same manner, either with the same hand or with the index finger of the other hand. But little practice is required to distinguish every feature of the cavity by the touch and to detect even slight abnormities in its condition. Only in certain cases of extreme nervous irritability have I been obliged to interrupt it.

Statistics.—Regarding the *frequency* of the occurrence of adenoid vegetations, it would seem that, at least in Denmark, it is great; and during eighteen months I have in my private practice observed not less than 102 cases. This number alone would, of course, not permit us to judge of their actual frequency, as persons thus affected will only apply for professional aid if either their speech is very defective or the complaint is complicated by some disease of the ear or by the occurrence of hæmorrhage. Among the above-mentioned 102 cases 52 showed the characteristic dead pronunciation, and 72 suffered from diseases of the ear. Among the 2000 children of the poor public schools of Copenhagen of both sexes (the majority being between ten and fifteen years of age), I found, in examin-

ing the whole number, 20 cases, or 1 per cent., of "dead" pronunciation, and in all of these I met with adenoid vegetations. On the whole, I have the impression that these growths are not more frequent among the poorer classes than among those better circumstanced.

Of the 102 patients mentioned above, the youngest was three and the eldest forty-three years of age. Nothing satisfactory could be ascertained regarding the duration of the vegetations. At the time of observation there were among those 102—

3	patients	under	5 years.
34	„	from	5—10 years.
25	„	„	10—15 „
21	„	„	15—20 „
11	„	„	20—25 „
1	„	„	25—30 „
4	„	„	30—35 „
1	„	„	35—40 „
2	„	„	40—45 „

Of these, again, 52 belonged to the male and 50 to the female sex. The ratio of the sexes was, however, very changeable at different periods of life; thus, of the patients from fifteen to twenty years of age, there were thirteen females and only eight males. This may be accounted for by the fact that young women of that age pay more attention to their defects of appearance than young men of the same age.

Causes.—On the etiology of adenoid vegetations I have but little to say. It seems that they are dependent on the same causes as the affections of the mucous membranes with which they are frequently complicated; and we very naturally feel inclined to regard struma as the most important cause, the more so as the structure of these adenoid vegetations so closely resembles those of the lymphatic glands. I must state, however, that only in a few cases have I observed other signs of a present or past strumous condition.

Local irritation of the mucous membrane of the naso-

pharyngeal cavity appears to have some influence on the development of a luxuriant growth of the adenoid tissue. This circumstance would, at all events, account best for the fact that among four individuals with cleft palate whom I latterly had occasion to examine three had vegetations, especially on the posterior wall. These cases enabled me to compare the results arrived at by rhinoscopy and digital examination, for in all three cases the posterior wall could be easily examined in its whole extent without the aid of a speculum. In one case, a lad thirteen years of age, I could observe the enlarged pharyngeal tonsil lying on the posterior wall, about the shape and size of half a plum, and of a brilliant red colour. On its surface shallow grooves were observed, indicating the crevices between the thick and soft lobes constituting the tumour. These three individuals all had very large clefts in the hard palate, accompanied by harelip. The fourth case, a girl of fifteen years, and *without* any vegetations, had no harelip, and the narrow cleft of the soft and hard palate only reached forwards to opposite the bicuspid teeth. In this case the naso-pharyngeal cavity being less exposed to external irritation from the food and cold air, the condition was not so favorable to the exuberant growth of the adenoid tissue. The number of my observations is, however, too small for determining the true relation between cleft palate and adenoid vegetations. But the matter deserves further investigation. I may here also call attention to the fact that, as a rule, subjects with cleft palate hear badly. Dieffenbach tried to explain this concurrent deafness by the circumstance that the muscles destined to act on the Eustachian tubes (tensores et levatores palati) were in such cases without their proper *point d'appui*. I would suggest that in a number of similar cases the deficiency of hearing might be due to a luxuriant state of the adenoid tissue in the naso-pharyngeal cavity. In one of the three cases alluded to I found the recessus laterales filled by such masses, and the mouths of the Eustachian tubes converted by the same into very narrow slits, which by the slightest catarrhal swelling would be closed altogether, and the patient's hearing was at times defective. In the fourth

case (the girl without harelip) the hearing was very perfect, and had never been bad, and the apertures of the tubes were in a normal condition.

Prognosis.—Respecting the prognosis of adenoid vegetations, the only questions are as to their natural course and the danger that might accrue to other organs by their presence. I have never had an opportunity of observing the undisturbed course of adenoid vegetations, and I cannot give an opinion as to their possible spontaneous disappearance or shrinking. It is probable, however, that this may be the case at an advanced age, for according to my observations we find many more children and young people affected with the characteristic speech belonging to this complaint than persons of a more mature age. I have repeatedly mentioned the influence exercised by vegetations on the hearing, especially by those attached to the sides of the pharynx. If, then, as happens in a number of cases, the removal of these growths restores the hearing which has been defective for a considerable time, we may safely assume that the swelling of the mucous membrane around these very vascular new formations has been the cause of the deficiency of hearing.

Treatment.—I am not aware that any internal remedies are able to check the growth of these adenoid vegetations of the pharynx. Iodine naturally suggests itself. But having once established the diagnosis, and considering the state of the middle ear at all times in jeopardy, I have never deferred the safe surgical treatment to the administration of uncertain internal remedies.

When the vegetations are small and of soft structure I employ *cauterization* with the solid nitrate of silver. In doing this I use firm, but light, metal holders fixed in a handle and curved at the other end, so that they may be passed behind the soft palate. They are flat at the extreme end and variously twisted, so as to be adapted to the position of the part to be cauterized, viz. backwards and upwards if the posterior wall is to be touched, laterally and towards the

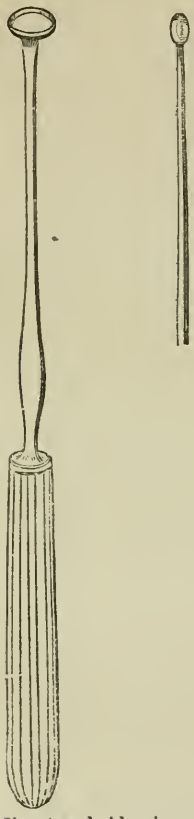
right or the left for the side walls, and so forth. The flattened end is dipped into melted nitrate of silver, care being taken to warm it previously, the caustic being liable to fall off if the metal is cold. The tongue of the patient being held down, the caustic is applied to a greater or less degree and extent according to circumstances.

Besides this cauterization, I also employ Weber's naso-pharyngeal douche, or instead of that complicated apparatus I use an india-rubber bottle, large enough to contain about sixteen ounces of fluid, and having an elastic, although firm, tube and nozzle. By this I inject into the nose a watery solution of common salt, or of the bicarbonate of soda (1 part to 500). The action of this douche not only consists in washing away the mucus, but also in altering the condition of the secreting surfaces. The late Dr. Yearsley used a similar "elastic tube or bottle," the effect of which he also compared to that of Weber's douche. I may here observe that many cases described by Yearsley seem to have been due to adenoid vegetations.[1] One is surprised, however, to find that this author, after describing with such exactness the mucous membrane of the nose and throat, and the connection of the affections of these membranes with morbid states of the tympanic cavity, only mentions in a cursory way the intervening naso-pharyngeal cavity, although this is so closely connected with the Eustachian tubes.

Whenever the larger vegetations are found to exist, I have recourse to an *operative procedure*, consisting in the crushing or scraping off of the tumours as near their base as possible. For this purpose I use an instrument devised by me and represented in the annexed cut. It consists, first, of a little ring of a transverse oval shape, its axes being 1·4 and 1 centimètre respectively, and its breadth 1·5 millimètre, having one edge sharp, although not absolutely cutting, and the other one rounded off; and secondly, of a slender, stiff, but at the same time flexible stem, 10 centimètres long, bearing the ring at one extremity fixed into a roughened

[1] 'Throat Ailments,' &c., pp. 75—78. Eighth edition, 1867. Also 'On Throat Deafness.' Tenth edition, 1868.

handle at the other. The pharynx having previously been rendered tolerant by repeated examinations, the patient is placed in a chair. An assistant holds the head, which is to be slightly bent forward, and the patient is requested to breathe deeply and regularly through the mouth during the operation. The surgeon, standing in front of the patient, introduces the left index finger into the naso-pharyngeal cavity, and with the right hand passes the instrument through the nose, keeping the long axis of the ring perpendicular, and making its blunt edge glide along the septum. In case the operation has to be done on the side wall, the stem of the instrument, which is made of soft steel, is to be bent towards the corresponding side. The point of the index finger and the instrument having been made to meet behind the posterior nares, the finger should now press each vegetation separately upwards against the ring, while the latter should be moved in a downward direction, so that its sharp edge crushes them off as near their base as possible, the nail or the point of the finger serving as a *point d'appui* for the instrument. The outer layer of the growths is frequently observed to resist the instrument much more sensibly than the interior, more fragile portion. In this manner the operator works gradually on (the finger all the time controlling the movements of the instrument), until everything necessary has been removed, or the patient becomes fatigued by holding the mouth open so long, or the bleeding compels the suspension of the operation. The bleeding is always considerable.



Front and side view of the instrument, one half the real size.

The blood flows through the patient's nostrils, and it is therefore well to let him hold a basin under the nose, which at the same time prevents him from taking hold of the instrument or the surgeon's hand. As a rule, the bleeding very soon stops; but to facilitate this, as well as to wash out the clots from the cavity after the removal of the vegetations, a strong stream of water should be injected over the bleeding surface. This is done by means of a tube shaped like an ear-catheter, closed at its extremity, but perforated at the sides by a number of holes, through which the water is pumped by an ordinary valved or syphon syringe. The patient may also be desired to blow his nose strongly into the basin, so as to force out the blood as well as the vegetations which have been detached. Finally, the bleeding spots should be well cauterized by means of the caustic holders already described.

The operation itself is never a very painful one. It causes a headache, especially at the back of the head, similar to that which follows the digital examination and the cauterizing of the parts; it may also produce a slight stupor a few hours after the operation, but this disappears the next day. I have never observed any other accident connected with the operation, unless some burning and irritation of the throat may be so called, although I have performed it above a hundred times.

One operation rarely succeeds in removing all the vegetations, so that it often requires to be repeated. I at first did this too soon, believing that the soft and uneven swelling which always follows the operation was the remains of vegetations. But the swelling disappears after a few days, and then any remaining vegetations can easily be detected. The vegetations on the fornix of the pharynx can be removed most easily, but those of the side walls often require a second operation, especially the hard and cristate, and also the cylindrical, wart-shaped, hemispherical kinds. I have sometimes had recourse to an instrument curved like a catheter, and of the shape of a lithotrite, but with spoon-shaped and cutting ends.

In some few instances neither the operation nor the *after*

treatment, by the use of caustics and the pharyngeal douche, has succeeded in removing all traces of the vegetations. In such cases the best method probably would be the employment of the galvano cautery as used by Voltolini, but I myself have never employed it.

The good *effects* of the operation generally appear quickly. As soon as the posterior nares are cleared the voice becomes more sonorous, the pronunciation clearer, and, as the respiration now occurs through the natural channels, the expression of the face is at once changed in a surprising manner. If any organic alterations in the tympanic cavity have already taken place, owing to the catarrh extending so far, the effect of the operation on this part may be trifling. But if such changes have not taken place, the hearing will be considerably improved, although the disease has continued for a long period, and I have even observed defects of the membrana tympani to be repaired after the operation. The anomalous signs above mentioned as occurring during the inflation of the Eustachian tube and tympanum by the air-catheter invariably disappear. In recent cases the hearing can be perfectly restored to its normal state, even without the employment of Eustachian catheterism. As a matter of course, the surrounding mucous membranes, which generally suffer at the same time, must have their proper share of therapeutical attention.

If the vegetations are completely removed by operation, I have reason to believe that the cure will be radical. At least I have never observed a *recurrence* of the complaint during the year and a half which have elapsed since I performed the first operation. It is true that I have paid especial attention to the after treatment, and continued it for a long time, and this plan I most urgently recommend to those of my confrères who may have an opportunity of removing the local disease by the above-described little operation.

It would be easy to illustrate the preceding descriptions by reports of cases from my journal, some occurring with and others without an accompanying defect of hearing. I trust, however, that I have said enough to induce others to apply

themselves practically to a complaint which, although not dangerous, is still very troublesome and important in its consequences.

DESCRIPTION OF PLATE V.

Adenoid Vegetations in the Naso-Pharyngeal Cavity.

Fig. 1. Cylindrical vegetations on right lateral wall of the naso-pharyngeal cavity, covering the opening of the Eustachian tube: remains of vegetations after operation in fornix and left lateral wall (rhinoscopical view).

Fig. 2. Microscopical view of a section of the adenoid vegetation from the fornix, $\frac{300}{1}$.

Fig 1.

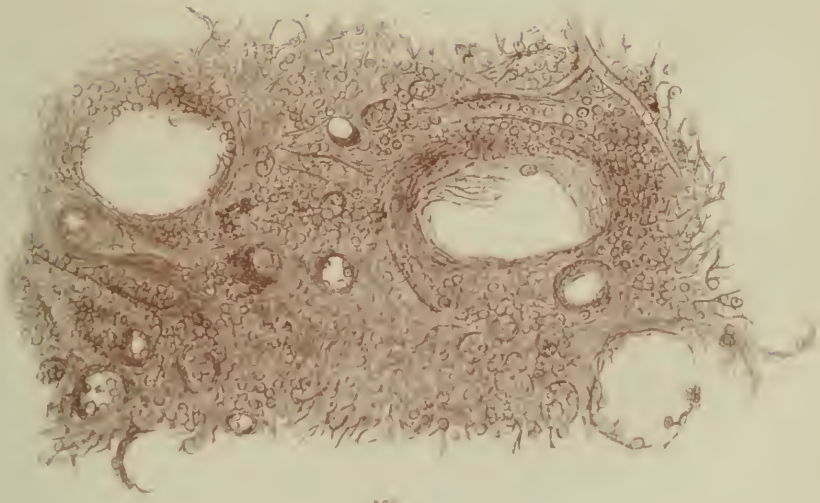


Fig 2

ON THE ANATOMY

OF A

CASE OF MOLLUSCUM FIBROSUM.

BY

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Received June 14th—Read June 28th, 1870.

Having recently had an opportunity of examining after death a case of Molluscum Fibrosum, I think it may be interesting to the members of this Society that I should bring the result of my investigation under their notice, more especially since the conclusions at which I have arrived are not in accordance with the current doctrines on the subject.

Sarah E—, æt. 40, was admitted into Guy's Hospital, under the care of Dr. Braxton Hicks, suffering from abdominal disease, which was correctly diagnosed as of a malignant nature. A hard uneven mass could be felt through the abdominal walls, consisting of cancerous disease of the omentum.

Scattered over the trunk and limbs of the patient were

innumerable tumours, occupying the skin and subcutaneous tissue. These were especially abundant on the trunk, but they also existed in considerable numbers on the limbs. They varied greatly in size; one of the largest, situated on the inner side of the right thigh, was as big as a walnut; most of them were much smaller. Some, especially on the back, were pedunculated, and were suspended from the surface of the skin; these were generally flaccid and flattened, evidently having been altered in shape by being pressed against the surface of the skin. Others lay beneath the cutis, each forming a flattened prominence, in which a lenticular mass could be felt, freely movable in its bed.

The poor woman gradually sank, and died on March 12th, 1870.

During the post-mortem examination portions of skin from the chest and back, containing a number of the tumours, were removed for further examination. It was particularly noticed that the palms of the hands were free from the disease; but on the sole of one foot there was a rounded elevation, which seemed to be caused by the presence of one of the tumours. This was therefore removed, with the surrounding integument; but on careful dissection no tumour could be discovered, nor any explanation of the appearance observed in the post-mortem room.

The portions of integument taken from the chest and back were carefully dissected in the recent state. The skin was turned over, the subcutaneous textures were removed, and the tissue of the cutis was incised, so as to lay bare the various tumours. These differed greatly in position and size, but all of them were fixed to the cutis at one or more points on their superficial aspect. Except at these points, however, some of the largest tumours lay almost entirely in the subcutaneous tissue; these were soft, reddish bodies, with a smooth shining surface, and sometimes presented curious outgrowths, as may be seen in Plate VI, fig. 1. Other tumours lay imbedded in the substance of the corium itself, the under surface of which had to be incised before they came into view; these were generally paler and flatter, and

seemed to be less sharply defined than those first described. The tumours which hung as stalked appendages from the cutaneous surface were not exposed until nearly the whole thickness of the skin was cut through towards the free surface. But when they were reached they were found to be very similar in character to those which were more deeply seated. They consisted of the same soft, reddish material, and did not seem to have become obsolete, or to have undergone degeneration, as might, perhaps, have been expected from their flaccid and shrivelled appearance.

But the matter of most interest was to determine the mode of development of the tumours. And, in the first place, it is to be remarked that the under surface of the integument was found to present a punctated appearance, which was quite peculiar. In the skin of the chest taken from a healthy individual the position of the hair-sacs is by no means obvious; in this case each of them was visible as a greyish point. The skin thus acquired a dotted character, like that which belongs to orange-rind and to certain kinds of leather.

Among the smallest masses which could be recognised as constituting distinct tumours some were so remarkably elongated as to project in the form of smooth, greyish-pink, tongue-like bodies into the subcutaneous tissue. These presented the most favorable opportunities for tracing the earliest development of the disease. When such a little tumour was carefully dissected out, a minute yellowish point was always found in its interior, near its base. This yellowish point could often be seen with a lens, or even with the naked eye, to have a finely lobulated structure; it looked very like a portion of one of the Meibomian glands in the eyelids.

On removing one of these small tumours, with a very small piece of the skin to which it was attached, and flattening it by gentle compression on a microscopic slide, the following appearances were observed, which are shown in the accompanying figure (Plate VI, fig. 2).

Entering the base of the tumour was a fine hair, the root of which lay imbedded in the interior of the mass; no

definite sac was observable from which this hair grew. Surrounding it was a beautiful arborescent glandular body, evidently developed from the sebaceous glands belonging to the follicle. It was this which constituted the yellowish point visible with the naked eye in the base of the tumour.

This glandular body was not only very much larger than a normal sebaceous gland from the same part of the body, it also presented much more numerous subdivisions, and these were more distinct and club-shaped in form.

The canal into which this glandular body opened, and in which the hair also lay, was in many of the tumours remarkably distinct, and very much wider than natural. Its size was, in fact, quite disproportionate to that of the hair, which thus bore nearly the same relation to the sebaceous glands which is normal in the skin of the nose.

The substance of the tumour itself appeared with a low power ($\frac{2}{3}$-inch objective) to consist of a semi-transparent fibrillated material. Since it included not only the hair and the glandular body above described, but also the whole extent of the follicle, the tumour must necessarily at this point have come close to the surface of the derma, although (as already stated) the other end of it penetrated into the subcutaneous tissue.

The larger tumours were likewise found to contain yellow glandular points, resembling those found in the smaller ones, but in these the relations were somewhat more complicated. In no case did the growth of the glandular body advance much beyond the point which it had reached in the smaller tumours, and which is shown in Plate VI, fig. 2. The larger tumours thus consisted almost wholly of the fibrillated material above described; but their attached base (towards the cutaneous surface) always contained at least one glandular point. As a rule, indeed, several such glandular points were present in each of the larger tumours. I was unable to decide whether this arose from the coalescence of several distinct tumours, or from the gradual extension of the morbid growth, involving several hair-follicles in succession.

The observations above described were made by flattening

the tumours (or portions of them) on microscopic slides, and examining them with a low power. They did not enable me to determine with certainty from what tissue the fibrillated material was developed which constituted the mass of the tumours. In the hope of throwing some light on this point, I prepared some hair-follicles and sebaceous glands from the skin of the chest of a healthy individual in precisely the same way. I then found that the tissue which immediately surrounded these was decidedly more transparent than that of the cutis generally, and it seemed to me that this must form the matrix from which the mass of the tumours arose.

Upon this question, however, much more light was thrown by some investigations made by my colleague Mr. H. G. Howse, who had removed some of the tumours from the body of Sarah E—, and had hardened them in chromic acid, so that he was able to examine them by sections.

The following report was kindly furnished me by Mr. Howse:

"The larger tumours were mainly made up of very fine connective tissue, in which an immense number of small oval corpuscles were disposed. These averaged a little over $\frac{1}{3000}$th inch long and $\frac{1}{8000}$th inch broad.

"The appearance of these corpuscles at first led me to suppose that they were the nuclei of involuntary muscular fibre. This, however, was disproved by the action of dilute nitric acid, which reagent was found to dissolve the intervening connective tissue, and to set the nuclei free; whereas it is well known that in the case of involuntary fibre the fibre-cells (and not the nuclei) are set free by nitric acid, unless, indeed, its action be too long continued.

"There was not any particular arrangement of this nucleated connective tissue, except that here and there it was disposed in bars across the preparation; these bars were also occasionally seen in tranverse section as circles, looking something like gland-tubes or vessels, from which, however, they were readily distinguished by their structure and by the absence of any central canal.

"Around the masses of this nucleated connective tissue there were bundles of wavy fibrous tissue, such as is so abundant in the ordinary subcutaneous tissue.

"In each tumour which I examined there were also sections of hairs, sebaceous follicles, and sudoriparous gland-ducts. The sebaceous glands were rather larger than those seen in sections of healthy skin, taken from the same parts of the body and prepared for the purpose of instituting a careful comparison. This enlargement amounted in extreme cases to two or three times the normal size. The sebaceous glands in the tumours were also more sacculated, and the acini further separated from one another, than in the normal skin. Indeed, I did not make out that the bulk of the *cavity* of the gland was in any case much increased; its larger size was due rather to the growth of a tissue between the sacculi, dividing them from one another.

"The contents of the follicles remained unaltered, and consisted of glandular epithelium, containing in its interior the usual granular fatty matter peculiar to this part.

"It remains to be considered from what normal structure the nucleated tissue was developed which made up the bulk of the tumours. Now, so far as I am aware, there is only one place in the corium in which tissue exactly like this exists, namely, in the two external layers of the dermal coat of the hair-follicles, these being fibrous layers with oblong corpuscles, disposed circularly in one layer, longitudinally in the other. These layers are reflected over the sebaceous glands, the ducts of which join the follicle, although they are not so distinct over these glands as over the follicle itself. It is therefore probable, nay, almost certain, that the tumours of Molluscum Fibrosum are due to an hypertrophy of the two external coats of the hair-follicle, and especially of that part of these coats which goes over the sebaceous glands.

"If this view is correct, the larger tumours must consist of aggregations of smaller ones. I found sections of three or four different hairs in those which I examined, which were all of them tumours of some size. It is probable that

the above-described wavy bundles of white fibrous tissue contained in the tumours marked out the lines of separation between what were originally distinct centres of growth.

"I did not notice any alteration in the appearance of the sudoriparous gland-ducts contained in the tumours. It is probable, indeed, that their presence was accidental, and arose from their being, as it were, entangled between adjoining growths. In one or two cases I found a coil of gland-tube within a tumour. This, however, may be explained in the same way, for (as is well known) the external dense tissue of the corium occasionally holds sudoriparous coils, although these are most generally placed in the subcutaneous fat."

The conclusions arrived at by Mr. Howse and myself as to the nature and seat of Molluscum Fibrosum are, then, as follows:

1. That each tumour is originally developed round a hair-follicle, enclosing at the same time the sebaceous glands belonging to the follicle.

2. That the smaller tumours consist of two distinct elements:—a central glandular body, itself surrounding a hair; and a peripheral mass of very fine connective tissue, containing numerous minute oval nuclei.

3. That the glandular body is a sebaceous gland, enlarged by the separation of its sacculi from one another, and perhaps also by the actual multiplication and increase in size of the sacculi themselves. The latter supposition is founded mainly on my own observations, made by flattening the smallest tumours *en masse*. The drawing which accompanies the paper appears to me to show that the sacculi are more numerous and larger than in the normal integument. Mr. Howse's accurate examinations of sections of the more advanced tumours failed, however, to determine the same fact.

4. That the peripheral mass of nucleated connective tissue is developed from the two external layers of the dermal coat of the hair-follicle and sebaceous glands. This point appears to be conclusively established by Mr. Howse's observations, which (I may add) he has given me opportunities of confirming.

The only difficulty which seems to stand in the way of the theory above laid down as to the nature of Molluscum Fibrosum is the fact that in some cases the tumours appear certainly to be developed in positions in which sebaceous glands are not known to exist, namely, in the integument of the palms and soles, and in the mucous membrane of the hard palate.

As regards the skin of the palms and soles, it is at least certain that the presence of the tumours of Molluscum in these regions is exceptional. In Dr. Beale's description of his case, which will hereafter be referred to, it is expressly stated that the palms of the hands and soles of the feet were free from the disease. They are so likewise in a patient (James Gray) now under my observation. But in another patient, a female who is also affected with well-marked Molluscum Fibrosum, two or three little tumours exist well within the margin of the palm of one hand. These tumours appear to be nearly as large as peas. It is true that their outline is less defined than that of tumours of the same size in other parts, but this may fairly be attributed to the difference in the character of the integument of the palm and in its relation to the subjacent tissues. I have already mentioned that in the case on which this paper is based there was apparently a growth in the sole of the foot, but that after its removal I could not discover any distinct tumour. It will be a point of great interest in future cases to examine any tumours of Molluscum that may appear to be developed in these regions.

Again, it has been pointed out to me by Mr. Hutchinson that in the case of James Gray, a man affected with Molluscum, of whom a portrait has been published by the New Sydenham Society,[1] there exist beneath the mucous membrane of the hard palate two or three flattened movable tumours, apparently identical in nature with those of the skin. It is probable, I think, that these growths in the palate are developed round the glands of the mucous membrane in the same way as the cutaneous growths round the sebaceous glands.

[1] Plate xvii. Catalogue, p. 58.

The patient, James Gray, is at present an in-patient under my care in Guy's Hospital. And in regard to the disease in his case, I have observed one fact which appears to be strongly confirmatory of the view which I have put forth as to the nature of Molluscum. Almost all of the tumours—at any rate of those which have attained some size—have on their surface the orifices of several sebaceous glands. Now, the point to which I wish to draw attention is this, that if the skin over a tumour be grasped between the finger and thumb, so as to lift it off the tumour, one finds that the surface is puckered in at the site of each orifice, which thus forms the centre of a little hollow. It is therefore evident that the skin is more closely adherent to the tumour at these points than elsewhere, and this can hardly be explained in any other way than by supposing that the sebaceous glands are uniformly included in its interior.

The view which my observations have led me to take concerning the nature of Molluscum Fibrosum differs, I believe, essentially, not only from that generally entertained, but also from the opinions that have been advanced by any previous writer.

Willan and Bateman appear to have been the first to use the word Molluscum as a substantive. It had, however, been previously employed as an adjective by two writers, Plenck and Ludwig. The former[1] speaks of a "verruca carnea, seu mollusca. Est tuberculum molle, sensile, cuti concolor, vel rubens, sæpe pilosum. In naso et facie plurimum invenitur." Ludwig uses the expression "verrucis mollibus sive *molluscis*," in his preface to an essay by his pupil Tilesius.[2]

It is remarkable that, in these two passages, reference seems to be made to the two distinct diseases which have been included under the title of Molluscum. The definition of Plenck could hardly be applied to any disease but Molluscum Contagiosum; the case recorded by Tilesius

[1] 'Doctrina de morbis cutaneis,' p. 87. 1776.

[2] 'Historia pathologica singularis cutis turpitudinis.' Folio, Leipsico, 1793.

appears certainly to have been one of Molluscum Fibrosum. The patient was a man, aged 50, whose body was covered with a number of tumours of very long duration, some having even existed at birth.

The recognition of the true nature of Tilesius's case is of some importance in reference to the history of Molluscum, for an erroneous interpretation of it appears to have been the cause of much of the confusion which has existed in regard to the affections known by this name. Bateman speaks of the tumours of Molluscum in general as containing "an atheromatous matter." In Tilesius's account of the case described by him it is noted that "in many of the larger tumours a small central aperture could be discovered, from which an oblong black body having a slender white root could be pressed out; being, in fact, what is commonly called a comedo."

Now, by subsequent writers on this subject it was very early discovered that in ordinary cases of Molluscum the tumours are made up mainly of fibrous tissue, and do not contain any appreciable atheromatous matter. I have not been able to determine precisely who originally propounded the opinion that the tumours of ordinary Molluscum are essentially fibrous. But at any rate it was fully recognised by Simon,[1] writing in 1851. This observer describes "Molluscum simplex seu non contagiosum," under the head of "Tumours consisting of Connective Tissue," while he places M. contagiosum in a different part of the work among "Sebaceous Tumours." In support of his opinion in regard to Molluscum simplex, he quotes the authority of MM. Cazenave et Schedel (1837), of Rokitansky, and of Krämer (1837).

It has already been remarked that Tilesius distinctly states that in his case bodies like comedones could be pressed out of the larger tumours. Hence it followed that both Cazenave[2]

[1] 'Die Hautkrankheiten durch anatomische Untersuchungen erläutert.' Berlin, 2te Auflage, 1851.

[2] 'Annales des Maladies de la Peau, et de la Syphilis,' vol. iii, 1850–51, p. 232.

and Simon[1]—holding the opinion that in Molluscum simplex the tumours were simply fibrous—referred Tilesius's case to M. contagiosum, and not to M. simplex, to which (as it seems to me) it unquestionably belonged. Both these writers consequently supposed that the two diseases included under the head of Molluscum might present a much closer similarity of appearance than I believe to be really the case.

In the same year in which M. Cazenave's paper on Molluscum was published in the 'Annales des Maladies de la Peau,' another French dermatologist, M. Caillaut, communicated an essay to the 'Archives Générales'[2] on the same disease. This writer regarded both the affections included under the title of Molluscum as affections of the sebaceous apparatus, and thus included both under the generic name of Acné, calling the one "A. molluscöide," the other A. pédiculée." The latter is the affection with which we are now concerned. Caillaut speaks of the smaller tumours, "which are pediculated and recent," as presenting follicular apertures, from which sebaceous matter can be pressed out. When of longer duration, he goes on to say, they lose these orifices, which become smaller and are at length obliterated. It is easy to trace these various stages in a patient who is covered with such tumours. "They are to be considered," he repeats, "as cysts resulting from the undue retention and accumulation of sebaceous matter in the cutaneous follicles." As might be expected, Tilesius's case is spoken of by Caillaut as an example of this disease.

The most cursory examination of the microscopical structure of the tumours of Molluscum Fibrosum could not fail to show the erroneousness of the opinion expressed by Caillaut in the passage above quoted, and accordingly I do not know that the writer of any later paper on this subject has committed a similar error. It is, however, remarkable that few dermatologists appear to have had opportunities of investigating the anatomy of Molluscum in the dead subject; with

[1] Op. cit., p. 354.

[2] 4e série, t. xxvii, pp. 46, 316.

the exception of Förster (to whose paper I shall presently refer), authors have generally based their statements on the examination of tumours excised during the life of the patient.

This remark applies, for instance, to the very important observations made by Dr. Lionel Beale, and recorded by him in the 'Transactions of the Pathological Society.'[1] The tumours which he examined were removed during life from a man, aged 60, by Mr. Bowman. The affection had commenced, thirty-seven years before, by the development of "small lumps in the skin, feeling like small shot when it was pinched." These little tumours had gradually been growing in size and in number ever since, but had given him no pain. The palms of the hands and soles of the feet were quite free from them.

From his examination of the tumours in this case Dr. Beale drew the following conclusions:

1. "That neither the sebaceous glands, nor the sweat-glands, nor their ducts, were concerned in the formation of the tumours.

2. "That the tumour consisted essentially of a morbid alteration of the structures concerned in the formation of the hair, especially of the cells at the deepest part of the follicle, and of the follicle itself.

3. "That the subcutaneous areolar tissue was considerably hypertrophied, both its white and yellow elements being coarser and more abundant than in health."

It will be observed that, although Dr. Beale's conclusions accord with my own in fixing the seat of Molluscum as having a definite relation to the hair-sacs, they differ in attributing the development of the tumour to cells of epidermic nature rather than to the dermal layers of the follicle. With regard to the sebaceous glands, Dr. Beale's *observations* appear to have been less opposed to mine than would be inferred from the *statements* above quoted. "For the most part," he says, "the sebaceous glands were very distinct and easily

[1] Vol. vi, 1855, p. 313.

found. They opened into a very wide canal, which could be traced to the surface of the skin. . . . . In many instances all their structural elements were clear and well defined. In other cases they appeared to have been pressed upon by the growth of the tumour, and in consequence several of the follicles had been absorbed. . . . . In other instances the glandular follicles had been entirely removed, leaving the wide tube into which they had originally opened." Dr. Beale makes no mention of any growth of the glandular tissue such as was observed in my case above recorded.

It may be remarked that Dr. Beale entitles his case one of "Molluscum" simply, and this accords well with the practice of English writers in general, who until recently have been apt to overlook the distinctness of the two diseases included under that name. There is no doubt, however, that the case in question was really one of Molluscum Fibrosum.

Not only have Dr. Beale's observations received but little notice from the later writers (chiefly Germans) who have published investigations in regard to Molluscum, but the views expressed by these writers have uniformly been opposed to his, since they have regarded the disease as consisting simply in the development of scattered fibrous tumours indifferently among the layers of the cutis.

Among the most important of the writings in which these opinions are maintained is an essay by Prof. Förster.[1] It is important, not only on account of the eminence of its author, but also because (as I have already remarked) it is perhaps the only paper that has hitherto been based on a post-mortem examination of a case of Molluscum. The disease is termed by Förster "Multiple Fibroma of the Skin." His description of it is quite definite and precise. He speaks of having had an opportunity, such as is rarely met with, of examining the disease in its very origin in the form of minute tumours scarcely visible to the naked eye. These all consisted of fully developed connective tissue, and were clearly seen to be

[1] "Ueber die weichen Warzen und Molluskenartigen Geschwülste der Haut.' 'Wien. Med. Wchnschr.,' 8 u. 9, 1858.

circumscribed growths of normal tissue-elements of the deeper layers of the cutis; the growth was in continuity with surrounding parts, and was not simply imbedded in them. In the skin covering the most minute tubercles there existed a small dark point resembling a comedo; but this was due to the fact that some of the tubercles developed themselves beneath or round hair-sacs, and as they gradually increased in size pushed the hair and its sebaceous glands upwards and to one side, or invested them entirely.

It will be seen that Prof. Förster's account of the structure of the smallest tumours above quoted is entirely inconsistent with my observations; nor, if the enlarged sebaceous glands, which were apparent to me, existed in his case, can I account for his having failed to discover them. It must therefore be left for future investigation to determine whether their presence is or is not constant.

The accounts given by later German writers have generally been in accordance with the statements of Förster. In the 'Krankhaften Geschwülste,'[1] Virchow publishes two lithographic portraits of a case in which the patient was covered with the tumours of Molluscum, or, as he prefers to term it, Fibroma Molluscum. His investigation of the disease appears, however, to have been limited to the examination of some of the tumours removed during life.

Among the most recent publications on this subject is one by Dr. F. G. Pick,[2] assistant to Prof. Hebra. This writer gives two cases. He cut off several of the tumours of various dates and sizes. They were very juicy, and of whitish-yellow colour on section. They were found to consist in the centre of embryonal, towards the periphery of circularly arranged, fibrous connective tissue. Dr. Pick goes on to remark that Hebra has suggested that the simultaneous growth of these tumours in various parts of the body is due to a general morbid condition, for which we have at present no name. Both his patients were stunted. "One was fat and short, while his brothers were tall. The other resembled

[1] Band I, p. 325.

[2] 'Wien. Med. Wchnschr.,' 1865, Juni, Nr. 49, p. 901.

a Laplander, with crooked legs, high shoulders, &c." Hebra has even hinted at an alliance between Molluscum and Lepra Tuberculosa.

This account of the literature of Molluscum is not complete without a reference to a paper by Prof. Engel,[1] although I believe that it has no real bearing on this subject. It is based on the examination of an old preparation in the Josefsakademie, of the nose of a man of middle age covered with numerous large pendulous tumours. These tumours presented large apertures of glands seated side by side. The glands are described as being enlarged and their acini multiplied, and the figures which Prof. Engel gives resemble very closely the appearances observed in the case which is the subject of my paper. But it is not clear to me that the sebaceous glands in this preparation were really larger than is natural in the skin of the region to which they belong, for it is well known that in the integument covering the nose these glands are much larger than elsewhere. Moreover, it is very doubtful whether the title of Molluscum can be justified, as applied to an affection which (so far as is known) was limited to the nose. The formation of pendulous tumours is common enough in extreme cases of Gutta Rosea, and it is to be expected that their structure should be precisely that described by Prof. Engel.

The view advanced in this paper as to the nature of Molluscum has the advantage of reconciling to a great extent the discrepancies in the opinions maintained by previous writers. Indeed, the only observations which appear to be absolutely opposed to mine are those of Prof. Förster above referred to. As, however, these seem to have been made with great care, they undoubtedly carry much weight. I therefore wish this communication to be taken, at present, as simply referring to the case which I had an opportunity of examining, and not as necessarily applicable to all cases which may appear to present similar characters.

[1] "Untersuchung eines Falles von Molluskum." 'Wien. Med. Wchnschr.,' 1865, Nr. 82, p. 1485.

It is evident that for any case resembling mine in its essential features the name of Molluscum Fibrosum is more appropriate than that of Fibroma Molluscum, used by Virchow and other German writers.

DESCRIPTION OF PLATE VI.

Fig. 1.—Portion of the skin of the back affected with molluscum fibrosum: the under surface dissected so as to expose the tumours lying at different depths in the substance of the skin. Natural size.

Fig. 2.—Microscopic appearance of one of the smallest tumours of molluscum; the entire tumour being simply flattened between two plates of glass. The accompanying scale represents hundredths of an inch.

Fig. 1.

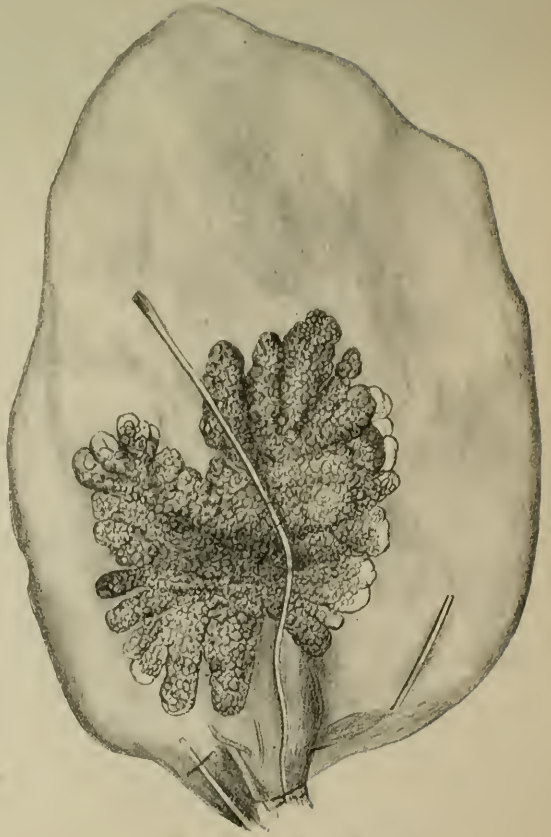

Fig. 2.

ON

CERTAIN MORBID CHANGES IN THE NERVOUS SYSTEM

ASSOCIATED WITH

DIABETES.

BY

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Received Jan. 11th.—Read Feb. 8th, 1870.

Diabetes has hitherto been regarded as a functional disorder, and has been attributed to erroneous action rather than structural change. This view, however, must be looked upon as only provisional. Function is simply the expression of structure. Structure and function are inseparable as cause and effect. A temporary disturbance of function has its source in a transient alteration in the solids or fluids of the body. Where, as in diabetes, function is permanently altered, there must needs coexist equally abiding change in the mechanism of the organs concerned. In this belief, relying upon our improved means of research, I have, as opportunity offered, inquired into the state of the more important organs in diabetic subjects. Using the method of Dr. Lockhart Clarke, it was at once seen that the nervous system was the seat of important alterations, an observation which gained

significance from the discovery of Bernard that puncture of a certain part of the medulla oblongata rendered the urine saccharine. I have therefore had special regard to the condition of the nervous centres, though I have not neglected to examine the lungs, liver, stomach, spleen, and kidneys.

Since the discovery of Bernard attention has been directed to the state of the medulla in persons who have died of diabetes, and cases have been recorded in which softening and other morbid changes have been here found. The lesions, however, have been various in kind, and little pathological importance has been generally attached to them.

M. Abeille[1] quotes from M. Luys two instances of diabetes in which there was softening, discoloration, and injection of the medulla, which lesions he regards as consecutive upon the malady, not as antecedent to it. Dr. Lockhart Clarke[2] described a softened medulla from an epileptic patient who was also the subject of diabetes, and other instances might be given in which disease in this neighbourhood has been found to accompany a saccharine state of the urine.[3]

The changes which have been alluded to, however, have been found with such comparative infrequency in connection with diabetes, the brain in this disorder usually being, to

[1] Abeille's treatise 'On Albuminous and Saccharine Urine.'

[2] Beale's 'Archives.'

[3] M. Lancereaux ('Bulletins de la Société Anatomique,' 1860, p. 221) describes the post-mortem examination of a diabetic subject in which the brain was softened, the ventricles dilated, and their walls discoloured, while there was much injection, with small extravasations about the calamus scriptorius, the nerve-cells being in this neighbourhood broken down and occupied by yellow granulations.

M. Luys, whose observations are alluded to above, describes the post-mortem appearances in two cases, one in the 'Bulletins de la Société Anatomique,' 1860, p. 247, the other in the 'Comptes Rendus de la Société de Biologie,' 1861, p. 24. The changes found in both were of the same kind—discoloration, vascularity, and loss of consistence in the neighbourhood of the fourth ventricle, with degeneration of the nerve-cells, which were occupied by yellow granulations.

M. Martineau ('Bulletins de la Société Anatomique,' 1861, p. 290) describes changes about the fourth ventricle similar to those previously described by M. Luys. The floor of the ventricle about the calamus scriptorius presented a greyish discoloration, with much injection of the blood-vessels.

ordinary examination, natural, that they have not been regarded as forming an essential part of the disease. In short, neither in the medulla oblongata nor elsewhere have such constant lesions been found, as to place the disease in question upon a pathological basis.

Dr. Pavy,[1] in his recent work upon the subject, thus expresses his own and the general view:—"Morbid anatomy has contributed nothing towards elucidating the pathology of diabetes. We have a manifestation of a disordered functional action without any discernible anatomical alteration to account for it."

As a contribution to the pathology of the disease I propose to describe, in somewhat minute but I trust not unnecessary detail, the post-mortem appearances in five cases, which are all I have been able to examine since my attention has been especially directed to the subject.

Case 1.—Thomas Hatcher, 6 years of age, was brought to me as an out-patient at St. George's Hospital, on the 25th of January, 1868. He was haggard and emaciated; the skin was harsh and dry; the tongue red; he suffered much both from hunger and thirst. The urine, which was estimated by his friends at four quarts daily, was found to be highly saccharine and had a specific gravity of 1048. He had lived poorly, getting meat only once a week. The urine had been noticed as excessive for six weeks.

He was taken into the house and placed upon regulated diet. He had bran cakes, gluten bread, meat, eggs, beef-tea, green vegetables, and milk. He took glycerine in his tea instead of sugar, and was allowed a small quantity of gin. Bread was at first allowed in small quantities, but after a short time entirely prohibited.

He took by way of medicine cod-liver oil and tonics, and subsequently small quantities of opium. He remained in the hospital for a period of nearly four months, at the end of which time the general symptoms had so far improved as to suggest his removal to the convalescent establishment at Mitcham.

[1] 'Pavy on Diabetes,' edit. 2, 1869.

While in St. George's the urine varied in quantity from 24 ounces to 110 ounces in the twenty-four hours. In specific gravity it ranged from 1035 to 1056; it was always abundantly saccharine. The temperature taken in the axilla was always excessively low, varying from 93·6° to 94·8°.

He returned from Mitcham, after a month's stay, much worse. He was thinner; the lips and tongue were dry; he lay in a lethargic state, as if half asleep, and resisted all attempts to give food or medicine. He had a frequent dry cough. The temperature had now risen to 97·8°. He passed into a condition of restless delirium, in which he died on the 12th of June.

On post-mortem examination the body was extremely emaciated.

When the head was opened the brain appeared to be somewhat congested. The ventricles contained some excess of clear fluid, though not enough to distend their cavities. No further morbid appearances were as yet observed, but the medulla, pons, and adjoining parts, were preserved in chromic acid for further examination. When they had become hard enough to give clean and sharp sections it was evident to the naked eye that extensive morbid changes had taken place. There were in particular several remarkable excavations, evidently the result of disease, which will demand more minute description. Microscopic examination showed the existence of extensive excavations throughout the substance of the medulla and pons. I will proceed to describe the morbid appearances in their topographical order, tracing them forwards from the spinal cord.

In the spinal cord, immediately below the decussation of the pyramids (the only part of the cord which was kept), was a small hole in the immediate neighbourhood of the central canal, which to the naked eye looked like the prick of a needle. The microscope showed this to be a cavity of an irregularly oval shape, formed partly in the white and partly in the grey matter. Nearly isolated within this space were some large blood-vessels, one of which had the characters of an artery, which was imbedded in a mass of closely nucleated

fibroid tissue. The vessels and the tissue in immediate contact with them were, except at one point of attachment, separated from the surrounding nervous matter by an empty space. The blood-vessels in the neighbouring part of the cord were more than naturally conspicuous, and many of them, particularly in the grey matter, had small irregular spaces around them. The vessels in the anterior fissure were apparently dilated, and the bottom of the fissure was eroded so as to form an irregular cavity, from the walls of which broken nerve-tubes protruded. In one anterior horn the nervous structure had become partially broken down, taking the form of the large translucent globules which so often give evidence of the disintegration of nervous matter.

In the medulla oblongata marked changes were found. These were situated in the vicinity of the median plane, in and about the olivary bodies, and in the grey matter forming the floor of the fourth ventricle. Close on either side of the median plane of the medulla, reaching nearly its whole length, was a slit or elongated excavation which measured an eighth of an inch in length and was very visible to the naked eye. The two cavities, which closely resembled each other, in some places communicated across the septum. They each contained a dilated blood-vessel.

Within and about the olivary bodies extensive degeneration of nervous matter had occurred in immediate relation with the large vessels by which those parts of the medulla are supplied. In the white matter within and around both corpora dentata were many vessels (apparently arteries) which were more than naturally conspicuous, and some of which had been altered in shape by dilatation. In the neighbourhood of some of these exaggerated vessels the brain matter was intermixed with the translucent globules which result from disintegration. In other places, where the changes had reached a later stage, the vessels were surrounded by cavities of considerable size and irregular shape. Sometimes a material which, under a high power, was seen to consist mainly of large transparent globules, adhered in bulk to the vessel, leaving an empty space between itself and the wall of the

cavity. The drawing (Plate VII, fig. 2) shows a swollen artery, affected as described. It occupied a flask-shaped excavation in the centre of one of the olivary bodies. The material described, consisting largely of the products of nervous disintegration, was attached to its outside. Thus, several stages of the process of excavation could be here seen. First a dilatation of a vessel, then a degenerative change in the nervous matter in contact with it, then a breaking down of tissue; the products of the disintegration collecting upon the vessel from which the change had commenced.

In the white matter near the centre of the olivary body was an irregular cavity about $\frac{1}{24}$ of an inch long, which contained no vascular structure but was irregularly occupied by the remains of nerve-fibres and globular *débris*.

Noteworthy changes were also found in the grey matter at the floor of the fourth ventricle. These were most numerous towards the upper end of the medulla, and resembled in character the alterations which have been described in the olivary bodies. Scattered through the grey matter were many small cavities of circular outline, one of the largest measuring $\frac{1}{70}$ by $\frac{1}{140}$ of an inch. Some were perfectly empty, others were traversed by blood-vessels and contained globular detritus.

In the pons Varolii morbid changes were found as striking as those in the medulla. At its posterior boundary, close to the root of one facial nerve, was a remarkable excavation, from the walls of which broken blood-vessels protruded. (See Plate VIII, figs. 3 and 4.) It had a somewhat oblong shape, was about an eighth of an inch long and half as wide, and lay a short distance beneath the surface of the pons in contact with, but not encroaching upon, the root of the facial nerve. This was evidently an enlargement of a fissure naturally existing in the pons which lodges a deep process of pia mater. This was seen on the other side of its natural size, quite inconspicuous compared with the large excavation described, and filled, as in health, with blood-vessels.

Near the front of the pons, in the median line, between the attachments of the anterior crura, was a cavity which

might have held a small pea. Its walls were irregular and broken, and from them several vessels protruded. Some comparatively trifling fragments of vascular structure lay in the cavity, which was for the most part empty. In the drawing (Plate VII, fig. 3) this excavation is represented of its actual size, and also slightly magnified.

Beside what have been described, many smaller cavities, mostly in connection with blood-vessels, were found in other parts of the pons. One, though narrow, measured a quarter of an inch in length. It had formed along the course of a large artery, which passed vertically into the pons in the median plane. It was traversed by the remains of nerve-fibres, and contained granular matter.

In the crura and optic thalami the blood-vessels were more than naturally conspicuous, and a few small cavities were seen such as were found elsewhere. Beyond this the examination of the brain did not extend.

The pneumogastric nerves were examined in section, and their structure ascertained to be perfectly natural. The semilunar ganglia were also examined without the detection of any abnormity.

The lungs were friable and loaded with serum. At the left apex was a small deposit of softened tubercle. The microscope showed many spots, apparently tubercular, where the air-vesicles were filled with a nuclear growth, and about which pigment had been deposited. In other parts the structure of the lung was natural.

The liver weighed 22 ounces; it was very hard, but not obviously changed in any other particular. Translucent sections were compared with similar sections of the healthy organ. There was a remarkable accumulation and crowding of the epithelium, such as almost to destroy the reticulated appearance of the lobular network by closing the interspaces which naturally exist. Beyond this excessive formation and close packing of the epithelial cells nothing unnatural was observed. The cells were rather opaque, but not in other respects abnormal.

The kidneys were pale, their surfaces slightly mottled; the

tubes, both straight and convoluted, were stuffed with epithelium to an abnormal extent.

The spleen and stomach proved on microscopic examination to be natural.

Case 2.—Edward Salisbury, aged 25 years, a plasterer, came under my care at St. George's Hospital, February 11th, 1869. His only complaints were of dryness of the throat and thirst. He had a ruddy complexion, rounded features, and the general appearance of health. It was learned, however, that the urine was excessive in quantity, and on examination it proved to be loaded with sugar.

His antecedents were as follows. From the age of seventeen he had been excessively given to promiscuous sexual indulgence, and furnished details of his performances in this particular which it is not necessary to repeat. A year later he began to drink ale and gin to the extent of becoming intoxicated on an average four times a week, sometimes going for a week without any interval of sobriety. At the age of twenty he unfortunately acquired a small inheritance, which gave him the means of indulging his vices without any interruption from the necessity of following his calling. Twelve months before he came to the hospital he began to pass water frequently during the night, but it was not until six months later that he noticed that the urine was increased in amount, the appetite at the same time being morbidly great. For the six weeks preceding his admission he had suffered from thirst, drinking water contrary to his previous habits.

When he came under observation the urine measured 188 oz. in the twenty-four hours, and had a specific gravity of 1033. The tongue was rather dry, and was evenly coated with a thin white fur. The pulse was small and numbered 68. The skin perspired freely.

He was first experimentally treated with peroxide of hydrogen, the diet being liberal, as suited to his appetite, but without restriction. Upon this he began to suffer from pain in the epigastrium and forehead, and the urine gradually increased, attaining on February 17th the maximum of 532 ounces, with a specific gravity of 1035.

Gluten bread was now substituted for the ordinary loaf, and grain doses of opium were given at intervals, instead of the peroxide of hydrogen. Under this treatment he improved in some respects. The urine diminished in quantity, but occasionally showed a trace of albumen. He more than once had attacks of vomiting, bringing up undigested food. He went on without any material change, but losing weight slightly, until the 21st of April, when he expressed himself as feeling quite well, and could not be persuaded to remain longer in the hospital.

The quantity of sugar in the urine was determined eight times between February the 18th and March the 21st. The proportion ranged from 22 grains to 68 grains in the fluid ounce. The amount of sugar passed in the twenty-four hours varied from 24,378 grains (more than 50 ounces) to 3720 grains (not quite 8 ounces).[1]

On the 15th of May I heard that he was worse and visited him at his own house. He was profoundly comatose, and died in this state on the following day.

With much difficulty permission was obtained to open the head, no other part of the body being disturbed. The brain to the naked eye appeared healthy; there was no marked injection of the vessels, nor any excess of fluid in the cavities.

The medulla, pons, and adjoining parts were removed, hardened in chromic acid, and examined with results which were almost identical with those obtained in the preceding case.

Beginning with the medulla there was on a level with the decussation a cavity in the same situation, and of the same kind as that described in the case of Hatcher. Close to the central canal, separated from it only by a thin layer of grey matter, was a circular cavity which, except that it was not empty, was like the prick of a needle. This contained an almost isolated core, consisting of a pair of dilated blood-vessels involved in a loose web of areolar tissue.

[1] For these observations, which may be relied upon as accurate, I am indebted to Mr. Noad.

Within and about the olivary bodies were some cavities in connection with blood-vessels, less striking, however, than those found in the preceding case.

Scattered about the grey matter forming the floor of the fourth ventricle, particularly towards its upper end, were many small cavities, some of which were empty, while others contained blood-vessels. The cavities were for the most part sharp excavations in the brain substance, looking as if a portion had been cut out. These frequently presented in transverse section, a more or less circular outline. Some were elongated, corresponding with the course of a vessel. The drawing (Plate VII, fig. 5) represents a cavity in this situation in which the vessel upon entering it was swollen into a bag; the space being traversed by nerve-fibres.

On reaching the pons a deep excavation was found at the root of one facial nerve, in the situation in which a similar cavity was found in the case of Hatcher. It communicated with the surface of the brain by a narrow neck, and was full of entangled arteries mixed with a small quantity of areolar tissue and broken-down nervous matter. This is represented (Plate VII, fig. 6) of the actual size.

Towards the front of the pons, in the median line, a vacuity was found, as in the preceding case, in connection with a process of pia mater. It was not, indeed, entirely empty, for it was partially occupied by something which to the naked eye had a gelatinous appearance. This proved to consist of a collection of vessels, mostly large and thick-walled, which lay sometimes in a parallel arrangement, sometimes tortuous and entangled, all imbedded in a translucent substance, which, from the delicate parallel lines it displayed was supposed to be an altered condition of the fibrous nerve-tissue. The vessels and all the surrounding tissues were sprinkled with minute yellow fragments. The edges of the space were fringed with broken vessels and nerve-fibres. The cavity, which, in its greatest extent, measured about $\frac{1}{12}$ of an inch, is represented of the size of nature. (Plate VII, fig. 7.) The contents of the space magnified 50 times are also displayed. The appearance was extremely striking.

The natural depression immediately in front of the pons was deepened, or rather undermined, by a large, irregular excavation which was in connection with a process of pia mater. This is represented of the actual size. (See Plate VII, fig. 4.)

The cavity was partly occupied by entangled arteries, belonging to the pia mater. The walls of the vessels were spotted with small yellow fragmentary or semicrystalline dots, as also was the adjacent nervous matter. Nerve threads and areolar tissue were entangled among the vessels.

In the optic thalami and corpora striata were many small rounded cavities, such as were found in the neighbourhood of the fourth ventricle.

Case 3.—Oliver Passenger, a stone mason, died at the age of 23 years in St. George's Hospital, where he had been twice a patient. He attributed his disease, which was first manifested by excess of urine, to exposure to cold while working at a cemetery. Three months after the first symptoms, two years before his death, he was first admitted under the care of Dr. Barclay. The urine then contained 7 per cent. of sugar. He left the hospital and was again admitted two months before his death, when the urine, still saccharine, had attained the amount of 390 ounces in the twenty-four hours, and had a specific gravity of 1028. Under regulated diet, which included bran cakes and gluten bread, and treatment by opium, the quantity of urine gradually diminished to 170 ounces, the specific gravity remaining the same. He, however, lost flesh latterly at the rate of a pound a day. Towards the close he complained of pain at the pit of the stomach, which was succeeded by pain in the head, drowsiness and coma. He died in February, 1869.

At the post-mortem examination a single mass of old crude tubercle was found in the right lung. The kidneys were large, soft and fatty, weighing 19 ounces. Their pelves were dilated. All the other organs were thought to be natural, excepting the brain. The subarachnoid cavity, and the lateral ventricles contained a considerable excess of fluid. The large vessels and sinuses were full of dark blood. The

white substance was congested to a pink colour, the puncta being much increased in number.

Mr. Pick, who made the post-mortem, reserved for my examination the parts which are about to be more particularly described.

Examining the brain in successive sections from behind forwards, alterations were found which were almost identical with those described in the previous cases.

Several cavities which contained vessels were clustered about the central canal of the cord on a level with the decussation. In the largest of these, which lay in the grey matter close to the canal, the vessel was greatly dilated, contained coagulum, and was encased in a thick layer of loose areolar tissue, between which and the wall of the cavity was an interval. (Plate VIII, fig. 1.) The cavities in this region were found to involve both the grey and the white matter.

On the same level the vessel in the anterior fissure was surrounded by a considerable quantity of loose nucleo-fibrillated tissue, and the fissure itself was excoriated at its base.

Higher up, changes were found in the median plane of the medulla, in and about the olivary bodies, and in the grey matter bounding the fourth ventricle.

In the median plane was a long slit, distinctly visible to the naked eye, which had ragged edges of broken tissue, and contained a vessel of considerable size.

Within and around the corpora dentata of the olivary bodies were large hollows with broken walls, which contained vessels, some of which were partly disorganized. The cavities were edged with globular and fibrous débris of cerebral tissue. One of these which lay in the central white matter of the olive, is represented in the drawing. (Plate VIII, fig. 2.)

One of the smaller cavities in the same situation was filled with globular débris, which was dotted with small masses of intensely yellow translucent material, probably a modification of blood pigment.

The grey matter of the medulla, forming the floor of the

fourth ventricle, particularly about the origins of the pneumogastric nerves, contained cavities, such as have been described in the preceding cases. A section made opposite the deep roots of these nerves showed in a striking manner the number and size of the vacuities.

Towards the front of the pons, almost exactly in the same spot as in the preceding cases, was an empty hole $\frac{1}{12}$ of an inch in its longest or transverse diameter, which probably had been formed in connection with the filament of pia mater which penetrates the medulla in this situation. Many large vessels distended with blood, and spotted on their outsides with yellow pigment, lay in the surrounding tissue.

Small cavities also existed on both sides in connection with vessels immediately beneath the line which separates the corpora striata from the optic thalami.

The pneumogastric nerves were natural in their minute structure.

The kidneys presented a marked condition of epithelial accumulation within the convoluted tubes, such as belongs to tubal nephritis.

The other organs were not subjected to microscopic examination.

Case 4.—Sarah Stewart, aged twenty-six years, married, came into St. George's Hospital under the care of Dr. Fuller, February 10th, 1869. She stated that for twelve months she had been out of health, and for eight months had been aware that the urine was excessive in amount. Five months before her admission she had miscarried.

When she came under observation the urine, which was highly saccharine and contained albumen, measured 200 ounces in twenty-four hours, and had a specific gravity of 1032.

She was dieted in the manner at present usual in diabetes, and was medicinally treated with peroxide of hydrogen. On the 17th of February she began to complain of pain below the epigastrium, and the peroxide was changed for a grain of opium twice a day.

On the 22nd she had pain in the head as well as in the epigastrium, and became languid and drowsy. The pupils then became closely contracted, she lapsed into a state of coma and expired on the 23rd.

Post-mortem examination.—The general aspect of the brain and spinal cord was natural; these organs, however, were not minutely examined in the fresh state, but were reserved for the microscope. After hardening in chromic acid the following changes were found.

The spinal cord presented throughout its whole length a striking dilatation and injection of the blood-vessels in the tissue and in the fissures; there was also an equally general disintegration of the nervous substance in their track, which was especially marked at the base of the anterior fissure and in the transverse commissure.

The morbid changes in each region may be more particularly stated.

In the lumbar portion, to commence at the lower end of the cord, the vessels in the anterior fissure and in the anterior horns were dilated. In the latter situation the tissue in contact with their walls was uneven and tattered, the course of the vessel being fringed with detached and irregular ends of nerve-fibres.

In the dorsal region alterations of the same kind had attained a greater extent. In and about the grey matter were many vessels swollen with blood in a remarkable manner. The bottom of the anterior fissure was eroded and filled with the products of disintegration. The commissure contained one, and in some cases two perforations, through which vessels passed, a considerable interval existing between the vessel and the broken nervous matter which bounded the space.

A similar description applies to the cervical region, the enlargement having undergone most change. The vessels were in the same state of exaggeration as in other parts of the cord. The commissure, where traversed by vessels, was extensively eaten away, insomuch that in some places it was

nearly cut in two. There were generally two eroded perforations one on each side of the central canal. The vessels which passed through them were still in some instances enclosed in an investure of areolar tissue, probably corresponding with what has been described as the perivascular sheath, there being an interval between this and the eroded nervous matter. In some cases the excavations beside vascular structure contained the remains of areolar and nervous tissue. In one place a cavity, empty, excepting for the remains of a small vessel, was found in the anterior horn. This is represented of the natural size, and also magnified 6 diameters. (Plate VIII, fig. 5.)

The medulla oblongata presented changes identical in nature, and similar in situation, to those observed in the previous cases.

About the median plane were some vessels which showed what seemed to be the first, or at least an early, departure from health. The vessel itself was unaltered, or altered only in capacity, but along its margin the brain tissue, which was as yet unbroken, was mingled with the globular matter suggestive of soap bubbles, which results from the decay of nervous structure. In the same neighbourhood were other vessels, around which the changes had proceeded to the formation of cavities, through which the vessel passed, enclosed in a thick irregular sheath of nucleated tissue, in which masses of pigment were scattered.

In the anterior fissure close to the pons, nearly in the spot where a similar change was found in the case of Salisbury, was an excavation at the root of a fold of pia mater. A group of arteries, swollen with blood and intermingled with a confused mass of extravasated corpuscles, passed into the fissure, and led to a broken cavity which lay among them, as if the tissue had been eaten away by its own vessels.

The lateral parts of the medulla, especially the olivary bodies, contained large vessels, external to the sheaths of which were traces of degeneration and erosion.

At the junction of the medulla and pons, the fissures,

into which the pia mater penetrates at the root of each facial nerve, were full of turgid vessels and extravasated blood. The vessels in the neighbouring tissue were similarly distended, and blood corpuscles were plentifully diffused into the surrounding nervous structure. It will be remembered that excavations were found in this situation in the cases of Hatcher and Salisbury.

In the pons varolii the vessels were generally injected, and were often edged with degenerate nervous structure. The changes here were not so far advanced as in the other cases.

In the septum of the ventricles the alterations were more striking. This was tunnelled more or less horizontally by channels, which when exposed by a transverse section, give an appearance of large porosity to the cut surface. Each canal held a vessel which, itself comparatively small, was surrounded by a sheath of loose translucent tissue, outside which was an empty zone bounded externally by the broken cerebral matter. Around and within the canals were many coloured grains, probably a form of blood pigment. In other parts of the septum were traces of degeneration around injected but otherwise natural vessels. (See Plate VIII, fig. 6).

Some of the convolutions presented a similar appearance. The white matter, exposed by a section perpendicular to the surface, was full of holes, of which the larger were one-twentieth of an inch across. These lay so close together as to give a cribriform aspect to the section; more than fifty were counted in a space less than half an inch square. Each was the section of a canal, which had an artery in its centre, the space around it being either empty, or occupied by a loose web of translucent tissue. The arteries were apparently enlarged; they were in most instances empty, but sometimes contained blood. Grains of a yellow colour were enclosed in the web around the vessels, and were abundantly sprinkled upon the walls of the canals. The grey matter of the convolutions remained perfectly natural; the nerve-cells were seen with typical distinctness. (See Plate VIII, figs. 7 and 8).

Passing to the other organs, the lungs were gorged with serous fluid, and contained two masses of grey hepatization, the larger of the size of an orange. The microscope showed that the smaller vessels were extensively occupied by coagulum evidently of some standing. The solidified parts showed the air-cells filled with a corpuscular semi-purulent product, among which were many small cavities caused by the breaking together of several adjoining cells.

The liver was fatty and loaded with blood, which was coagulated in many of the vessels. Under the microscope the coagulum was found to occupy many of the smaller veins both portal and hepatic. The epithelium was superabundant and densely packed, as in the case of Hatcher.

The kidneys, like the liver, were congested, and the smaller vessels occupied by coagulum. The epithelium of the convoluted tubes was excessive and crowded.

The organs which have not been mentioned were apparently natural; this statement includes the semi-lunar ganglia, which were minutely examined.

Case 5.—The following case came under notice after the greater part of this paper had been written.

William Hudson, 32 years of age, came into St. George's Hospital under the care of Dr. Fuller, on the 16th of last December. He had had symptoms of diabetes for six months. He was much emaciated, had pain in the epigastrium, and was evidently near his end. The urine measured 96 ounces in the twenty-four hours. It had a specific gravity of 1026, and contained a considerable quantity of albumen as well as sugar. He died three days after admission, death being preceded by contraction of the pupils and coma.

On post-mortem examination the pleuræ were found to be adherent, the lungs congested, the bronchial glands occupied by cretaceous matter. The kidneys weighed jointly 11¼ ounces, they were slightly granular on their surfaces, and the tubes abnormally full. A small depression of old standing, which was attributed to caries, was found on the frontal bone. The encephalon weighed 49¼ ounces; it was

to the naked eye in all respects natural. The other organs were normal in appearance.

Dr. Whipham, who made the post-mortem, gave me an opportunity of subsequently examining the nervous centres. Without entering into minute detail, it will be seen that the results confirm the observations which relate to the preceding cases.

In the spinal cord the same excoriations existed in the fissures, and along the course of vessels in the commissure, and in the horns. There was also in the dorsal region a remarkable enlargement of the central canal, which occupied the greater part of the width of the commissure, and was a conspicuous object to the naked eye.

The central canal (of which an outline is given in the woodcut) had an oblong shape; the transverse diameter, which was the larger, measured $\frac{1}{34}$ of an inch. The epithelial lining was still there, but had in places a somewhat irregular and frayed appearance. The canal contained a small quantity of granular matter, apparently derived from disintegration.

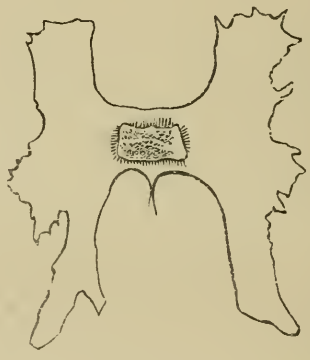


FIG. 1.—Outline showing the enlargement of the central canal of the cord in the case of Hudson.

In the medulla the olivary bodies were channelled along the beds of the vessels as already so often described. There were erosions in the central plane of the medulla which looked as if the tissue had been partially dissolved; and there

were large and numerous cavities about the vessels of the grey matter at the floor of the fourth ventricle.

The fissure on the inner side of the left facial nerve, which has, in the previous cases, been noticed as the seat of morbid change, contained traces of extravasated blood, while corpuscles had escaped into the tissue from some of the neighbouring vessels.

A large hole of the same character lay in the median plane near the front of the pons, exactly where found in those of the four cases already related, which was in connection with a process of pia mater which dips in between the anterior crura. It was an exaggeration of a natural cavity. The vessels within it were injected and blood was extravasated about them.

The corpora striata, optic thalami and the white matter of the cerebral convolutions also presented changes in connection with the vessels similar to those found elsewhere. A good example of extravasation and destruction of tissue existed about one of the vessels of the corpus striatum.

The right and left upper ganglia of the cervical sympathetic cord were examined in section without the observation of anything abnormal in their structure.

The results obtained in the five cases examined are briefly these; peculiar morbid changes were constantly found in the cerebro-spinal system. In all the alterations were of the same nature, and in similar situations. The earliest alteration recognised consisted in a dilatation of the blood-vessels, particularly of the arteries, with accumulation and frequent extravasation of their contents. The next was a degeneration of the nervous matter at certain points outside the swollen vessels, probably caused by the intrusion into it of blood-corpuscles. The degenerative process occasioned destruction and excavation of the tissue round the vessel. Cavities were thus produced, often large enough to be striking objects even without the microscope, which contained blood-vessels, extravasated blood, grains of pigment, and the products of nervous decay. Finally, the contents

appeared to become absorbed, so that simple vacuities were left. The perivascular sheath was variously stretched and altered in character and became loaded with pigment, but it seemed that these alterations were consequent upon the dilatation of the vessel, extravasation of blood, and excavation of nervous matter.

As to their situations the changes occurred in constant association with arteries. They were found in every part of the spinal cord and encephalon, attaining their greatest development in the medulla oblongata and pons Varolii. The excavations were generally the most marked where the blood-vessels piercing the brain were the largest and most numerous. They were frequently in connection with folds of the pia mater. The regions affected with the greatest frequency were the olivary bodies, the vicinity of the median plane of the medulla, the grey matter of the floor of the fourth ventricle, a fissure just internal to the origin of the facial nerve which lodges a process of pia mater, and a depression similarly occupied which penetrates from between the anterior crura towards the centre of the pons Varolii.

The optic thalami and corpora striata were involved, though to a comparatively slight extent. The septum of the ventricles and the white matter of the convolutions displayed the alterations in a remarkable manner. The changes especially affected the white matter, though the grey matter at the floor of the fourth ventricle and of the spinal cord are exceptions to this statement.

In the cord the most conspicuous change was the enlargement of the central canal probably connected with degeneration of tissue, of which many evidences were found there and elsewhere.

The nerve-cells of the brain and cord were generally perfect.

Such parts of the sympathetic system as were examined, namely, the upper cervical and semilunar ganglia, were apparently natural.

The only constant change found in the viscera was epithelial accumulation in the liver and kidneys.

So far as the foregoing observations extend it would seem that diabetes is associated with a substantial change, which follows the arteries of the brain and cord, and comprises injection, extravasation, and destruction of tissue. From the uniformity with which such alterations were found in the five cases examined, it may be presumed that there was a more than accidental connection between the symptoms of diabetes and the peculiar state of the nervous centres. The question at once presents itself whether the lesion is a result of the change of secretion or is antecedent to it; or have the lesion and the symptom no closer connection than as the effects of a common cause?

The last hypothesis may be dismissed as unsupported by our present knowledge. If such a common cause exists it has hitherto eluded our observation.

The association of the morbid change with the blood-vessels suggests that it may be a result of the state of the blood. We know that the blood in diabetes is altered by the presence of sugar; Is it to this that the deterioration is due? Several considerations militate against this, at first sight, probable explanation. The veins and capillaries appeared to take no share in the morbid process, though they must be equally permeated by diabetic blood, which, in the capillaries at least, is brought into more intimate relation with the tissues than in the arteries. If the changes in the tissue were directly due to the altered composition of the blood the capillaries could hardly fail to distribute its morbid influence. Beside this, the blood traverses the whole body without producing in any other organ an analogous failure of nutrition. We may probably abandon the view that the changes described are consequent upon the diabetic state of blood, and have recourse to the supposition that the nervous alterations are antecedent to, and productive of, the glycosuria.

The following considerations give likelihood to the belief that the nervous changes are primary. No organic alteration has been found elsewhere to which the saccharine state of the urine can be attributed. The changes in the brain are in their nature and situation such as physiology has shown to be

capable of producing that symptom. Further, we are the more disposed to regard the condition of the nervous centres as primary by the fact that alterations similar in kind, though differing in distribution, occur as belonging exclusively to the nervous system, quite independently of diabetes. This is the case particularly in the general paralysis of the insane. Dr. Lockhart Clarke[1] has, since most of the preceding descriptions were written, described the lesions observed in that disorder, and shown that, though differing somewhat in situation, they are of the same nature as those here described. In general paralysis the change chiefly effects the convolutions and pons varolii, leaving the lower part of the medulla and cord natural; there is also wasting of the nerve-cells. In diabetes, as has been seen, the medulla is affected throughout, the nerve-cells remaining perfectly natural.

The pathology of the nervous system is yet in its infancy. The minute anatomy of many disorders which are well known clinically has still to be unfolded. We cannot tell how far such alterations as are associated with diabetes and general paralysis are common to other cerebro-spinal disturbances. A loss of arterial tension in nerve-tissue appears to be the first recognisable step in tetanus as in diabetes, and it is not improbable that some such morbid process as has been described in this paper may prove to be a mode of nervous failure producing different symptoms, and known by different names according to its location in one part or another of the nervous structures.

The conclusion that diabetes is primarily and essentially a nervous disease accords with all that is known of its natural history; indeed, the opinion has of late years been gaining ground that the disorder is due to altered nervous action, though no structural change was known to account for it. The urine often becomes saccharine in consequence of injuries of the head, apoplectic seizures, intra-cranial tumours, and other sources of cerebral irritation. These traumatic and accidental forms of the disease are, as we may believe, not necessarily accompanied by the grave and general lesions

[1] 'Journal of Mental Science,' January, 1870.

which have been under consideration. Several kinds of irritation, if acting in the right situation, give rise to a similar change in the urine, though often temporary, and for the most part, though not always, unaccompanied by the serious symptoms which characterise what may be termed "idiopathic" diabetes.

Diabetes in its ordinary "idiopathic" form, though sometimes hereditary, and often taking its origin in causes which are not within our knowledge, continually results from circumstances which exert a depressing or otherwise injurious action upon the nervous functions; among them may be mentioned mental disturbances, rage, grief, anxiety, and intellectual toil, and the various forms of dissipation, among which sexual excess takes a prominent place.

Causes of this nature may readily give rise to modifications of circulation in the nervous centres, and it has been shown that, as far as could be learned from the microscope, a widening or distension of the arteries is the initial change in the pathological series.

The foregoing observations concur in leading to the belief that diabetes essentially belongs to the nervous system, a consideration which must have a practical issue in modifying the treatment of the disease.

Postscript.—Since the preceding paper was presented to the Society I have examined the nervous system in two other cases of diabetes with results which I will briefly state.

Case 6.—The first was a man named William Rock, 39 years of age, who died February 5th, 1870, in St. Mary's Hospital, under the care of Dr. Handfield Jones, to whom, in conjunction with Dr. Payne, I am indebted for the opportunity of examining the nervous structures. The patient died somewhat unexpectedly of pneumonia, a considerable extent of grey hepatization being found after death. The liver and kidneys were somewhat enlarged but there was nothing to call for particular attention excepting in the nervous centres.

The spinal cord had a natural appearance externally, but on section there was found to be in the lumbar region an extraordinary enlargement of the central canal. This measured $\frac{1}{27}$ of an inch in width and was filled with granular material which seemed to have issued from two spots, one on each side of the canal, where the epithelium was absent, and the granular material was inseparable from the tissue around being superficially intermixed with it.

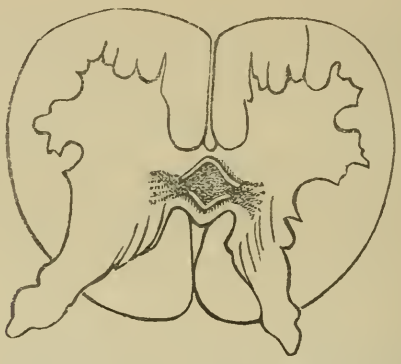


FIG. 2.—W. Rock. Lumbar region showing enlargement of the central canal.

This contained material was yellowish, granular, and nearly structureless. A few globules could be found in it suggestive of its origin in the degeneration of nervous tissue. It will be remembered that a similar enlargement of the central canal was found in the case of Hudson already related (page 250).

In the cervical region were such evidences of destruction of tissue as have been described in the previous cases. These were found particularly at the base of the anterior fissure, at one part of which was a deep excavation with broken edges, which nearly severed the commissure.

The brain weighed 2 lbs. $11\frac{1}{2}$ oz.; it was greatly hyperæmic; the subarachnoid and cerebro-spinal fluids were abundant, and were found to contain a large quantity of sugar.

The microscope brought into view changes of the same

kind as in the preceding cases. One of the most conspicuous was in the olivary body, where a large artery, with an irregular and thickened sheath, lay in an eroded channel in which was detritus of nerve-structure. This was much like what is represented as occurring in the case of Passenger (Plate VIII, fig. 2), but the destruction of tissue in the present instance was the more obvious.

The puncture for pia mater in front of the pons was exaggerated, as has been so often described before, and contained vessels which were distended with blood to considerably more than their normal diameter.

In the corpora striata were corroded channels which contained large, irregular, and apparently dilated, vessels, with much bright yellow pigment upon their outsides, while their cavities were often crammed with blood-corpuscles.

In the white matter of the cerebellum was an irregularly ovoid channel, $\frac{1}{50}$th of an inch in diameter, the sides of which were encrusted and the interior partly filled with the globular debris of nerve-structure. An irregularly swollen artery, which contained altered coagulum, and a small vein lay within: about them were many grains of yellow pigment. The cavity, as seen in section, was very striking; from its irregularity and discoloration it was evident to the naked eye as the result of disease.

The upper cervical ganglia of the sympathetic were also examined. Dr. Payne, in taking them out, observed that the right ganglion was somewhat larger than the left, and was of a pink colour. With the microscope I could not detect anything abnormal further than that the vessels of the right were injected, those of the left empty.

Case 7.—Dr. Sturges sent me the central parts of the brain of a woman who, while suffering from diabetes, died in the Westminster Hospital of an illness apparently unconnected with that disorder.

Without describing the brain in detail, I may say that the morbid appearances in the medulla were of the same kind as has been described in the preceding cases, though less extensive.

In the white matter of the cerebellum were large vessels, packed with corpuscles, which lay in eroded channels. The appearances were most conspicuous in the central part of the dentate body; the numerous and naturally large vessels in

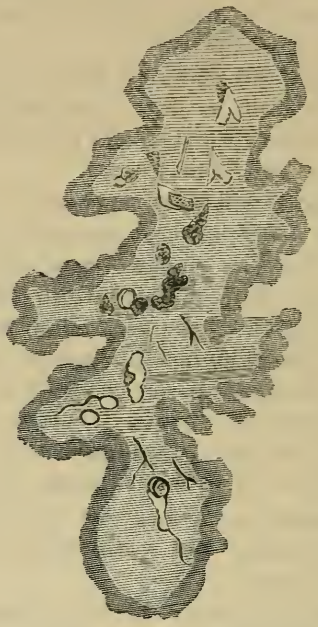


FIG. 3.—Corpus dentatum of cerebellum.

this situation were irregularly crammed with blood, and the tissue around them was eroded and discoloured.

In front of the pons were striking and instructive changes. These consisted of scattered extravasations which had to the naked eye the appearance of large black dots and streaks disposed with some regularity about the divergence of the anterior crura. The dark masses consisted of blood-corpuscles in irregular or elongated heaps, through the midst of which a vessel could often be traced. In some places the corpuscles were not accumulated, but were disposed as a narrow fringe along the course of the vessel. Here and

there cracks and fissures had occurred between the vessel and the extravasated blood; on the side removed from the vessel the corpuscles were intermixed with the tissue without any abrupt separation. It was clear that these hæmorrhages had taken place as the result of transudation or migration, not of rupture.

The two additional cases coincide closely in the nature of the post-mortem appearances with the five previously related, and support the views which have been expressed.

The last instance is of especial interest from the fact that the patient died while apparently the diabetic changes were in a comparatively early stage. Extravasation of blood was found where in the more advanced examples was destruction of tissue. Blood and blood-pigment were frequently noticed in the preceding cases in and about the perivascular excavations, but the nature of the connection between the hæmorrhage and the erosion was a matter only of conjecture. The last case places the two processes in their natural relationship, and shows that interstitial hæmorrhage is an active agent in the destructive operation.

DESCRIPTION OF PLATE VII.

Figs. 1—3 illustrate the post-mortem changes in the case of Hatcher (Case 1, page 235).

Fig. 1.—An oval cavity at the lowest part of the medulla close to the central canal. Shown of the natural size, and also magnified 150 diameters.

Fig. 2.—An excavation around an artery in the central part of the olivary body. The artery is covered with the products of nervous degeneration. Magnified 150 diameters.

Fig. 3.—A large excavation in the anterior part of the pons Varolii. Shown of the natural size, and also magnified 4 diameters.

(Further illustrations of this case are given in Plate VIII.)

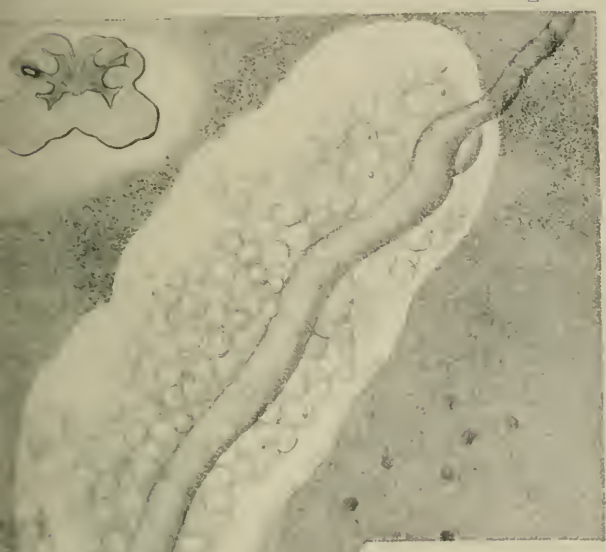
Figs. 4—7 represent the post-mortem appearances in the brain of Salisbury (Case 2, page 240).

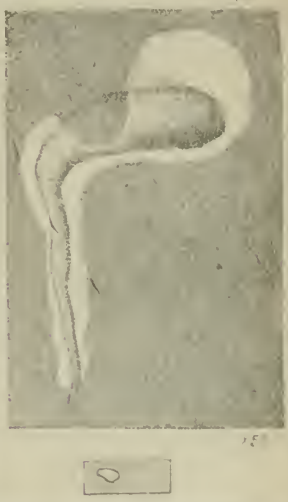
Fig. 4.—An excavation in front of the pons. Natural size.

Fig. 5.—A cavity around a dilated blood-vessel in the grey matter near the floor of the fourth ventricle. Of the natural size, and magnified 50 diameters.

Fig. 6.—Cavity at the root of the facial nerve. Natural size.

Fig. 7.—Cavity in the median line near the front of the pons containing arteries and nervous detritus. Natural size, and magnified 50 diameters.





DESCRIPTION OF PLATE VIII.

Figs. 1, 2, represent the post-mortem appearances in the brain of Passenger (Case 3, page 243).

Fig. 1.—A cavity around an artery opposite the decussation in the lowest part of the medulla. Of the natural size, and magnified 50 diameters.

Fig. 2.—Cavity around an artery, in the white matter of the olivary body, edged with broken-down tissue. Of the natural size, and magnified 50 diameters.

Figs. 3 and 4 represent the post-mortem appearances in the pons Varolii of Hatcher (Case 1, page 238).

Fig. 3.—A section of the posterior part of the pons Varolii of the natural size. It shows the excavation at the root of the facial nerve.

Fig. 4.—The cavity at the root of the facial nerve magnified 20 diameters. The broken vessels are seen protruding from the wall. The root of the nerve is seen close to the end of the cavity.

Figs. 5—8 represent the post-mortem appearances in the brain and cord of Stewart (Case 4, page 245).

Fig. 5.—The grey matter of the spinal cord in the cervical region, showing considerable excavations in the commissure and the lateral grey matter. Of the natural size, and magnified 4 diameters.

Fig. 6.—A transverse action of the septum of the ventricles, showing large excavations about its blood-vessels. Of the natural size, and magnified 6 diameters.

Fig. 7.—The white matter of a cerebral convolution, showing numerous cavities, some containing blood-vessels. Of the natural size, and magnified 20 diameters.

Fig. 8.—One of the cavities in fig. 7 magnified 50 diameters, showing a loose web containing grains of pigment around the vessel, presumed to be an altered condition of the perivascular sheath.

ANOSMIA;

OR,

CASES ILLUSTRATING THE PHYSIOLOGY AND PATHOLOGY

OF THE

SENSE OF SMELL.

BY

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Received January 11th.—Read January 25th, 1870.

I wish to bring before the Society some cases in which the sense of smell was either entirely lost, or greatly impaired. This I do not merely because such cases are comparatively rare; but because I think they may perhaps throw some light on the physiology of a sense which has been less studied than any other.

I will begin with three cases which have fallen under my notice in which smell, and smell alone, was completely lost.

Case 1.—Mr. B. fell from a horse twenty-seven years ago, and struck his head heavily against the ground, on the left side and in the posterior part. Ever since the accident he has been liable to headache, and his "nerves are not so

strong as they were." He has also ever since completely lost the sense of smell. The very strongest odours brought under his nose produce no sensation whatsoever. The tactile sensibility of his nostrils is with this quite unaffected. The slightest touch of the mucous membrane is felt perfectly, and snuff produces tickling and sneezing. He states that he has lost not only the sense of smell, but also that of taste: for he cannot in the least distinguish one meat from another. Boiled onions, boiled apples, boiled turnips, all appear the same to his palate. He cannot at all recognise the aroma or flavour of wines; though he can distinguish wines from each other to a certain extent by their different degrees of roughness and of sweetness. Port, for instance, he can tell from claret by its being sweeter and less rough. Besides sweetness he can distinctly recognise saltness, bitterness, acidity. Excluding these qualities, one substance is exactly like another to his palate, excepting so far as they are more or less hard and rough.

Notwithstanding all this he is not absolutely indifferent as to his food. He has preferences, derived apparently from memory;[1] and he especially dislikes any new article of diet.

There is no muscular palsy, no loss of sensibility, nor other symptom than those mentioned.

Case 2.—Mr. —— was knocked down by a cab some two years ago, and fell backwards, striking his occiput heavily against the road. For a minute he was stunned, but recovered, and managed to get home, where he was laid up for a time suffering from the local injuries, and from severe headache. All this, however, passed off, and he was left with no other permanent symptom than total loss of smell. This has remained without change ever since the accident. He cannot perceive the very strongest odours, that for instance of assafœtida. The tactile sensibility of the

[1] "*Ce sens*," says Longet, speaking of combined smell and taste, "*manque de mémoire*." The impressions of flavour would, however, appear from the above to be more permanently retained in the mind than Longet would admit.

nostrils is perfectly normal. Ammonia salts and snuff tickle his nostrils, and cause lachrymation or sneezing as in other men. He states that he has lost not only smell but taste. Cinnamon appears to his palate utterly without flavour. He cannot tell one meat from another when his eyes are shut, though he can in some degree distinguish various articles of diet by their tactile qualities. He cannot recognise the aroma of wine. Port, he says, tastes like sugar, claret like weak vinegar. The former also seems thicker than the latter. He can not only recognise sweetness and acidity, but also bitterness and saltness. This, however, is the limit of his gustatory perceptions.

He is not quite indifferent as to his food, but still has fancies and preferences, dependent perhaps on habit. So also he still smokes.

Case 3.—C. L— was admitted into hospital in February, 1869. He had been knocked about the head in a drunken row the preceding Christmas, and ever since had suffered from strange sensations in the head, and from occasional attacks of nose-bleeding. He was somewhat deaf since the injury to his head, and had completely lost his sense of smell. He could neither smell assafœtida nor buchu. He stated that he had also lost his taste; but he could perfectly distinguish quinine, table salt, and sugar, from each other, and pronounced each correctly to be bitter, salt, or sweet. After a short stay in the hospital, serious head symptoms declared themselves, and the man became so noisy and violent that he had to be removed; and eventually he became, I was informed, insane.

In all these three cases it is manifest that the sense of smell was entirely lost, and the first question is, How was this brought about? There can, I think, be little doubt that the loss was due to rupture of the olfactory nerves, as they pass from the bulb through the holes in the ethmoid bone. In the last of the cases the repeated nose-bleeding points to some injury done to this part of the skull. The deafness which accompanied the anosmia, and the subsequent violent head

symptoms, render it not improbable that the base of the skull had in this case been fractured.

In the other two cases it will have been noticed that the blow which caused the anosmia was on the occiput. Now it is well known that a blow at the back of the skull is not nearly so likely to injure the part of the brain immediately underneath as it is to injure the anterior and inferior portion, where the olfactory nerves lie. And the reason for this, as Mr. Hilton has pointed out, is, that the anterior brain rests directly upon the bones of the skull, and is not separated from them as is the case elsewhere by the interposition of cerebro-spinal fluid.[1]

It is easy to understand how a blow, which is not sufficiently violent to do serious mischief to the anterior brain generally, may still suffice to tear the olfactory nerves, owing to their very small size, and, still more, owing to their excessive softness. In only one recorded case of loss of smell from a blow on the head, have I found mention of the exact part struck. There also, as in these cases, the blow was on the occiput.[2]

It will have been noticed that in each of these three cases the patient complained of having lost taste as well as smell. If we use "taste" in the popular sense, as including the perception of aroma or flavour, doubtless each had done so. But if we limit "taste," as physiologically we are bound to do, to those sensations, other than tactile, which are communicated by means of the gustatory and the glosso-pharyngeal nerves, then in each the taste was unimpaired. For there was no difficulty in recognising either acid, bitter, sweet, or saline. Pure taste is limited to the perception of these few qualities, and any additional perceptions, other

[1] Hilton, 'Lectures on Rest and Pain,' p. 25. "When the blow is received at the posterior part of the skull, the whole mass of the brain being driven forwards from the momentum given to it by the blow upon the bones of the skull, the under surface of the anterior part of the brain rubs over the depressed and elevated surfaces which constitute the anatomical features of the internal base of the skull."

[2] 'London Hospital Reports,' vol. i, p. 470. [Since this paper was read, another case of permanent anosmia from a blow on the head has come under my notice. Here, also, the occiput was the part struck.—July, 1870.]

than tactile, which food may give us, are derived not from taste but from the much wider sense of smell, and are due to irritation of the olfactory nerves. We are so accustomed to the combination of simultaneous gustatory and olfactory impressions, that we have come to look on the two as one, and in popular language have confused them together. But disease splits this compound sensation of flavour into its constituents, and leaves the olfactory or the gustatory element to stand by itself, according as the latter or the former set of nerves have been injured. So much larger a share of the compound is due to smell than to taste, that, when a man has lost the former, he thinks, as in these cases, that he has lost both; whereas, if smell remain and true taste alone be lost—as sometimes occurs—the patient is almost regardless of his changed condition.

Doubtless we see from time to time cases which seem to stand in contradiction with the view here taken of the nature of flavour. These are cases in which the sense of smell, as tested by the application of odoriferous substances to the nostrils, seems entirely lost, while, notwithstanding this, the perception of flavour remains in comparative integrity. It is the existence of such cases which has caused physiological writers, as a rule, to define so hazily the limits of pure taste. The cases are, however, not difficult to explain. It will invariably be found in them that the olfactory nerves and region are sound, and that there is a free access for odours to this latter through the posterior nares, while some hindrance or other prevents the odours reaching it from the anterior nostrils. In other words the sense of smell in these cases is not lost; but defects in the accessory mechanism prevent its being exercised in one of the usual ways, while they do not prevent its being exercised in another. One or two of such cases which I have observed I shall now consider.

Case 4.—J. H— came under my observation in 1867, suffering from double facial palsy. This was complete on the left side, and almost complete on the right. In addition to the usual well-known symptoms he complained of loss of

smell, and I found that with the left nostril he could hardly smell the strongest odours, while with the right nostril he could smell somewhat better, but still very imperfectly. Notwithstanding this he retained not only the sense of true taste, but also the power of perceiving flavours. He could tell one meat from another, distinguish aromatic substances, and so forth.

In every well-marked case of facial palsy, a similar anosmia may be observed, if trial be made of the nostril on the affected side. This fact is noted in most of our physiological text-books, but in none can I find any clear explanation of the cause of the anosmia. It becomes necessary, therefore, to consider the mechanism of voluntary olfaction.

There are two modes in which we purposely smell at a substance. In the one we close the mouth and then take a long deep inspiration through the nostrils. During the inspiration the nostrils are widely dilated, so as to give as free an entrance as possible to the air current. This, charged with odour, sweeps over the whole internal surface of the nose, the olfactory region included, and excites a sensation proportionate to its own velocity.

The second method is not quite so simple but much more efficacious. Here, as before, we close the mouth, but, instead of then taking one long deep nasal inspiration, we draw in the air by a rapid succession of short, shallow, but forcible "sniffs." If the nostrils be watched during this process, it will be seen that, so far from dilating as before, they actually contract at each "sniff." And a little attention will show that the contraction does not include the whole anterior opening, but only its posterior portion. At the same moment the cartilaginous sides of the nose may be seen to undergo lateral compression, by the action of the compressor naris muscle; and by this compression, which is most strongly marked in the part answering to the small sesamoid cartilages, the sides are brought slightly nearer to each other, and of course also to the central septum.

Now inside the nose the mucous membrane which covers the middle turbinated bone is prolonged anteriorly in an

elevation, called by Meyer[1] the agger nasi, which curves round and runs in a direction nearly parallel to the edge of the nose, till it reaches a point very near the anterior nasal orifice. By this agger and the middle turbinated bone the nasal cavity is divided into two parts, an upper or anterior one—the olfactory channel—and a lower or posterior, and larger one—the respiratory channel. The agger, which forms in part the boundary, approaches very near to the central septum, and the narrow chink which separates it is rendered still narrower by the great thickness of the septum in the part opposite to it. There is, indeed, according to Meyer, a kind of prominence on the septum answering to the prominence of the agger. A very slight lateral compression, therefore, of the nose would bring agger and septum into actual contact, and cut off the olfactory channel above from the respiratory channel below. This lateral compression is, as we have seen, brought about at each "sniff" by the contraction of the compressor naris. Were this all, the air-current at each sniffing inspiration would merely be divided into two parts, one of which would traverse the olfactory, the other the respiratory channel; but, at the same time as the two channels are separated, the anterior opening into the lower or respiratory one is closed, or at any rate greatly contracted by the lateral compression, which, we have seen, attains its maximum over the sesamoid cartilages, that is, just at the entrance into this channel.

It may, perhaps, seem doubtful whether the lateral compression is sufficient to bring the outer wall and septum, in this part, into actual contact, seeing how widely apart, speaking comparatively, they here are. So far as I can judge from my own sensations the contact does take place. It must, moreover, be remembered that, after all, the interval is an excessively narrow one, owing to the great thickness of the mucous membrane. And, secondly, I would point out that exactly across the entrance into the respiratory channel runs a line in which the external cartilaginous wall of the nose is broken, and replaced by yielding fibrous tissue. This line of

[1] 'Lehrbuch d. Anat.,' p. 620.

breakage runs between the upper lateral and the lower lateral cartilages, and is continued by the sesamoid cartilages round the back of the ala. It corresponds, that is, very closely with the direction of the compressor naris muscle, which covers it. When, therefore, this muscle contracts, it is plain that its pressure, acting of course with greatest effect where the resistance is least, will bend the external wall of the nose inwards, along the line in question, and bring it into more or less complete contact with the close-lying septum. By this contact the entrance into the respiratory channel will be closed, and the inspired air compelled to pass by the narrow but deep groove which leads to the olfactory region.

There is thus a useful purpose to be found in the otherwise unmeaning anatomical fact that the external wall of the nose is formed by the union of several pieces of cartilage, and not by one single expansion.

If the explanation I have offered be correct, it is plain how facial palsy must interfere with voluntary olfaction. With the first method it interferes by preventing active dilatation of the nostrils; with the second, by preventing the lateral compression which is required to close the respiratory channel. At the same time it will not materially interfere with the perception of flavours, for there is no hindrance to the passage of odours from the mouth upwards through the posterior nares.

Besides these cases of facial palsy, there is yet another class of cases, by no means uncommon, in which the perception of flavour remains, while the perception of odours by the anterior nostrils is lost. Of this class the following is an example.

Case 5.—Mrs. H— enjoyed, until some few years ago, the same powers of smell and taste as do other persons. She then suffered from a violent cold or influenza, which left her with chronic inflammation of the nasal mucous membrane. This, however, has long subsided, leaving her in the following condition. She cannot inspire air through the nostrils with the same ease and fullness as can others, and feels as though

there were some obstruction when she tries to do so. Exspiration, however, through the nose is much freer, and is not attended by any similar feeling of obstruction. The voice is somewhat nasal in tone. The most strongly smelling substances may be placed under her nostrils, while she inspires through the nose, without her perceiving in the least degree their smell. This I tested several times with such drugs as assafœtida and valerianate of iron. The tactile sensibility of the nostrils is normal; and she uses smelling salts and is affected by them as other folk. Notwithstanding this apparently complete anosmia, her perception of flavours remains almost in its integrity. She can tell one meat from another, distinguish various wines, and so forth without difficulty; though she admits that she does not think her palate is as accurate as that of most other people, or as was her own before the influenza.

Here then, again, we have an apparent contradiction to the statement that flavour is chiefly derived from smell. It is, however, not difficult to find an explanation. We have only to suppose, what is in itself highly probable, that the Schneiderian membrane has been so thickened by chronic inflammation as to bring the septum into contact with the middle turbinated bone and its prolongation, the agger nasi, a result which, we have already seen, would require only an excessively slight thickening of the membrane; and, secondly, that this thickening has not only thus cut off the olfactory from the respiratory channel, but that it has also obstructed the former and narrower of these two, the obstruction being of such a kind as entirely to prevent the passage of air inwards, while it allows of the passage of air outwards. We must suppose, that is, that the projecting fold of membrane acts as a valve. That this was the case is rendered almost certain by the fact that the exspiration through the nose was much freer than was the inspiration.

Supposing, then, that this very probable anatomical lesion has been left as the result of the chronic coryza, the apparent contradiction will be fully explained. The power of smelling through the anterior nostrils is gone, because there is no

access through these to the olfactory region. The perception of flavours remains because there is a free passage to this region from the mouth through the posterior nares.

Such cases, then, as these are not incompatible with the opinion that flavour is almost entirely due to smell. On the other hand, such cases as those given at the beginning of this paper are incompatible with any other opinion, if it be admitted (as I think it must) that the only damage done was to the olfactory nerves, and did not include the gustatory or the glossopharyngeal.

Incompatible also with any other opinion are those cases which occasionally occur in which the soft palate adheres to the posterior wall of the pharynx, so as to cut off all communication between mouth and nasal cavities. When this happens not only is the power of smelling through the nostrils gone, but with it is lost also the perception of flavours in the mouth, though both nerves of taste and nerves of smell are in their integrity. When the communication is established, either spontaneously or by the surgeon's knife, the perception of flavours and of odours is at once restored. The following example of this state of things I have recently had the opportunity of examining through the kindness of Mr. Gascoyen, whose patient the man is.

Case 6.—E. C— has suffered for some three years from adhesion of the posterior pillars of the fauces to the back of the pharynx. Two years ago this adhesion was so extensive that it was barely possible to pass an ordinarily sized director upwards between the wall of the pharynx and the central portion of the soft palate. Nasal respiration was impossible, to the man's very great inconvenience, who was unable to blow his nose, was utterly without smell, and had lost all perception of flavours. So great was his discomfort, that he was urgent to have an operation performed for his relief; but this was not then thought advisable. He has since improved much, and his present condition is as follows. The posterior pillars are still adherent to the back of the pharynx, but it is now possible to pass the tip of the little finger upwards

underneath the central palate which is not adherent to the pharyngeal wall. This passage upwards is, however, under ordinary circumstances closed, for the free portion of the soft palate is kept pressed back and in contact with the wall of the pharynx by the adhesion of the pillar on either side. While this is the case the man is completely unable to smell or to distinguish flavours, though he can still perfectly recognise true tastes, viz. sweet, salt, acid, bitter. This is his usual condition. But by an effort he is able momentarily to open the passage behind the velum, and when he does this he can for the time both smell and recognise flavours. On looking into his throat one can see that, during this effort, the free central part of the velum is pulled forwards away from the posterior wall of the pharynx, by the agency, I presume, of the palatoglossal muscles.

A case very similar in its general features to the above, was published some years back in the 'Lancet,'[1] by Mr. W. Coulson. There also the soft palate was adherent to the pharyngeal wall, and smell, together with the perception of flavours,[2] was suspended. No sooner, however, had an opening been made through the soft palate, than these lost faculties were restored.

I have now given cases in which the anosmia depended on injury to the olfactory nerves, and others in which the accessory organs of the sense were in fault. I pass on to cases in which the lesion was central.

Case 7.—E. D— was admitted into St. George's Hospital with right hemiplegia. He was also suffering from partial aphasia and agraphia. He complained of loss of smell. I tested the sense by bringing strong-smelling drugs to his

[1] 'Lancet,' 1862, p. 529.

[2] The patient in this case is said to have lost not only perception of flavours but also of some true tastes, such as of sugar, and of salt. It does not, however, appear that this was actually tested by Mr. Coulson, and it can hardly be supposed to be anything but a mistake. How could the adhesion possibly prevent the man from tasting salt, seeing that this can be distinctly tasted if applied to the tip of the protruded tongue, while the mouth is kept closed, and the nostrils compressed with the fingers?

nostrils, and it appeared that he was almost, though not quite, insensible to them. The tickling of ammonia salts, however, affected him normally. This man eventually recovered almost completely from his palsy and his aphasia, and at the same time his sense of smell returned also.

Case 8.—A. F— is at present under my care. After suffering for some time from acute pain in the left frontal region, he had a fit which left him with aphasia and agraphia, both of the amnemonic form.[1]

The aphasia is not so complete as to prevent him from making himself understood. There is no paralysis. He can smell much better with his right nostril than with his left one. When the right one is plugged and asafœtida placed under the other, sometimes he says he cannot smell it at all, at other times that he thinks he can smell something pleasant, but is not quite sure. The tactile sensibility of the nostril is normal.

Case 9.—E. L—, æt. 12, is now under my care. A month or so ago he suddenly lost power in his right side, and fell down without losing consciousness. A few hours later he had a fit, which left him with partial aphasia and incomplete hemiplegia of the right side. He has entirely lost smell in the left nostril. He cannot on this side perceive either peppermint, or assafœtida. The other nostril is of normal sensibility. There is no murmur with the heart-sounds.

I have seen other very similar cases. These, however, are sufficient for my purpose. Moreover, I am not the first to call attention to the frequent coincidence of anosmia with aphasia. A very interesting case of the kind was published in 1864,[2] by Dr. Fletcher and Mr. Ransome; and since then Dr. Jackson[3] has recorded three other examples of such coincidence. There can then be no doubt that aphasia and

[1] Cf. "Aphasia and Agraphia," a paper contributed by me to 'St. George's Hospital Reports,' vol. ii, p. 99, 1867.

[2] 'Brit. Med. Journ.' April, 1861.

[3] 'Lond. Hosp. Reports,' vol. i, p. 410.

anosmia are frequently combined, and it is not impossible that our knowledge of the pathology of the former may help to explain the latter. Now it will, I suppose, be admitted, even by the most determined opponents of cerebral localisation, that, at any rate, in a great majority of cases of aphasia, a brain lesion exists in close proximity to the fissure of Sylvius. To the floor of this same fissure can be traced the so-called external root of the olfactory bulb, finding, according to some anatomists, its ultimate termination in the island of Reil. It is, therefore, highly probable that the loss of smell in cases of aphasia results from the brain lesion extending into the fissure of Sylvius, and implicating the fibres of this root or their central termination. If this be the explanation, as can, I think, scarcely be doubted, the presence or absence of anosmia in cases of aphasia will for the future be perhaps of some use in enabling us to fix with greater precision the site and extent of the brain lesion.

In these cases it will be noticed that the loss of smell is only partial. It is confined to one nostril, this being, as anatomy would lead us to expect, on the same side as the brain lesion. But, even in the affected nostril, smell is not usually completely lost but only much impaired. At first one would be inclined to explain this by supposing that those parts of the cerebrum with which the middle and internal roots of the olfactory bulb are connected also take some share in the perception of olfactory impressions. But, seeing that sometimes the loss of smell is complete, as in Case 9, this explanation can hardly hold good;[1] unless, indeed, we are prepared to assert in such cases the existence of multiple lesions affecting all the various olfactory roots. The more probable explanation therefore is, that the external root is the only one of the three which is directly concerned in olfaction, and that it depends upon the degree in which this root or its central termination has been disorganised, whether the loss of smell be complete or partial. This view

[1] Another case of right hemiplegia, accompanied by aphasia, with the most complete anosmia of the left nostril, the right remaining normal, has come under my care since this paper was read.—September, 1870.

derives additional likelihood from the observation made many years ago by M. Serres,[1] that lesion of the external root is much more efficacious in determining anosmia than is lesion of the internal root. Nineteen post-mortem examinations of paralytic patients confirmed, he says, this result.

The cases I have as yet brought forward have all fallen under my own observation. I beg leave now to call attention to a case which was recorded many years ago in the 'American Journal of Medical Science.'[2] This case seems to have been passed over as a mere medical curiosity, but I think I shall be able to show that it possesses very considerable physiological interest.

A boy in Kentucky, son of two black slaves, had up to his twelfth year a skin of the same dark colour as that of his parents. At this period a white patch appeared near the inner canthus of the left eye. This white patch spread gradually, until in ten years' time it extended over the whole external surface of the body : so that, but for his woolly hair, the boy might have been taken for a very fair European. Later on, some few brownish or copper-coloured spots appeared on the face and hands; but the parts which were not exposed retained permanently their perfect whiteness. At the same time that the boy began to change his colour, he began also to lose the sense of smell, and by the time he had become white his smell was so seriously impaired that Dr. Hutchison, who records the case, states it to have been completely lost. There are, however, in the published account some observations which seem to render it rather doubtful whether this was the case.[3] At any rate smell, if not entirely lost, was very greatly impaired.

Dr. Hutchison does not appear to have supposed that

[1] Chez les malades que j'ai observés, l'alteration matérielle de la racine externe a paralysé l'olfaction d'une mauière beaucoup plus prononcée que de l'interne. Dix-neuf ouvertures de sujets ayant succombés à des paralysies out confirmé ces résultats." 'Anat. comp. du cerveau,' i, 295.

[2] See op. cit., 1852.

[3] My reason for doubting is this. The boy is said to have retained his taste completely. Now, Dr. Hutchison seems to use the word "taste" in the popular sense, as including the perception of flavour. If the boy

there was any connection, save of coincidence, between the loss of colour and the loss of smell. It is, however, I think, almost impossible to suppose that the simultaneous occurrence in the boy of two such extraordinary phenomena can have been merely fortuitous. At the same time it is not manifest at first sight how the two symptoms were bound together. The connecting link is, I venture to suggest, to be found in the fact that the mucous membrane of the olfactory region is, like the rete mucosum of the skin, rich in pigment; and it is not unreasonable to suppose that the mysterious disease which destroyed the pigment in the one tissue may also have destroyed it in the other. Physiologists have entirely passed over the constant occurrence of pigment in the olfactory region, regarding it apparently as a matter of no possible interest or importance. I cannot, however, but think that in this they are mistaken, and that there are good grounds for supposing that the presence of pigment, if not actually necessary for olfaction, at any rate conduces much to its keenness and perfection. The grounds on which I base this opinion, I shall now proceed to examine.

In the first place, then, it is a striking fact that not only in man but in all mammalia the epithelium of the olfactory region is pigmented, though that of the rest of the nostrils and of the sinuses is colourless. That is to say, pigmentation extends to all the region which is receptive of impressions of smell, and extends no further. One cannot but suppose that some useful purpose is implied by this persistence. Secondly, if we compare one species of animal with another, there appears to be some correspondence between the amount and intensity of this nasal pigmentation and the acuteness of

retained this he had not completely lost "smell." The tests, however, which Dr. Hutchison used, were not sufficient to decide whether the perception of flavour remained. He found, for instance, that the boy could tell bacon from turkey. This could be done by pure taste, for one is salt and not so the other. Butter could be distinguished from lard. This may, however, be explained by tactile differences; perhaps also by differences of saltness. Molasses again from honey. Here also there is a difference in sweetness, and also a tactile difference.

smell. I have been unable to obtain such perfect data on this point as I could wish; but this much at any rate I can state: that in the dog, the cat, the fox, among carnivora, the sheep and rabbit among herbivora—all animals in which this sense is highly acute—the pigmentation extends over a larger space, and is of a darker tint than is the case in man, where the sense is comparatively rudimentary.[1] Again, not only does the olfactory region in man contain less pigment and lighter coloured pigment in its epithelium than is the case with more keenly smelling mammals, but it is also entirely or almost entirely without any of what are called Bowman's glands, which in the other animals are abundant.[2] But these glands of Bowman form a secretion, rich in molecules of yellow and brown pigment;[3] and this secretion keeps the olfactory region constantly covered with a layer of pigmented mucus.

Thirdly, a similar correspondence between extent of pigmentation and keenness of scent seems to exist when we compare one race of men with another. We may fairly assume that in the dark-skinned races there is, as a rule, more pigment in the olfactory region than is the case in races of lighter hue. For it is known that the excessive pigmentation of a negro is not confined to the skin, but extends internally to the iris and choroid, and even, as Meckel first pointed out,[4] to the tissue of the brain; an observation which was afterwards confirmed by Le Cat and others. Now it is a

[1] In man the olfactory pigment is of a lightish-yellow tint. In the cat it is of a deep yellow-brown, and extends over a relatively larger surface than in man (Ecker). In the fox the pigment is of the same colour as the hair, viz., a red-brown, and there are abundant glands of Bowman, secreting a pigmented fluid (Ecker). In the dog the pigment is brown or yellowish-brown. In the rabbit it is brown (Krause), sienna-brown (Todd). In two sheep I found it almost black; but the colour must be variable in sheep, for Kölliker found it yellowish.

[2] Cf. Fick. 'Anat. der Sinnesorgane,' p. 92. In man the place of Bowman's glands is occupied by ordinary mucus-glands. See also Ecker's plates.

[3] Cf. 'Frey's Histol.,' p. 666.

[4] Le Cat, 'Traité de la couleur de la peau humaine,' &c., 1765, p. 51. Le Cat's observation was "confirmed subsequently by Meckel and others, and very recently by M. Gubler," says Dr. Laycock, 'Brit. and For. Med.-Chir. Review,' 1867, p. 187. Sömmering, however, in three dissections of

striking fact that it is in these coloured races that the sense of smell acquires its greatest perfection. In most physiological text-books instances are given of acute smell: and these instances will be found invariably to be derived from coloured races of men. The Arabs of the Great Desert are said to be able to distinguish the smell of a fire thirty miles off. The North American Indian is said to be able to follow his enemy or his game, like a hound, by the scent. A like keenness belongs to the Indians of Peru, according to Humboldt. The African negro can distinguish the traces of a white man from those of a black. Lastly, of all the inhabitants of Asia it is the black Kalmuck who is described as possessing the most extraordinary delicacy of olfaction.[1] These facts are the more trustworthy, that their various reporters had no thought of any connection between the colour of the skin and the keenness of scent, but explained this latter either as the effect of long-continued practice, or as the result of patulous nostrils.[2]

A similar correspondence between the degree of nasal pigmentation and the keenness of smell may, I think, be detected even in white individuals, by comparing one period of life with another. The olfactory sense is apparently but feeble in youth; children being notoriously dull in perception of flavours, which, as already said, are chiefly derived from smell; whereas their perceptions of true tastes are as keen as those of adults, sweets attracting them, and bitters, salts, or acids being, as a rule, repugnant to their palates. Now, in all young animals the nasal pigmentation is much less

negroes, found no such cerebral pigmentation. Cf. '*Ueber die Körperliche Verschiedenheit des Negers*,' &c., 1785. It is therefore probably not a constant phenomenon. So also Le Cat found more pigment in the brain of black rabbits than in that of white ones (op. cit., p. 55), but not invariably (p. 57).

[1] Single examples are not worth much. Still it is interesting to note that Mohammed, the only historical personage, so far as I know, who was renowned for the excessive sensitiveness of his smell, was also remarkable for the deep blackness of his eyes and of his hair. His head "even in advanced age was sprinkled by only about twenty grey hairs." See 'Quart. Review,' October, 1869, p. 303.

[2] 'Haller El. Phys.,' t. v, 179. 'Longet, Phys.,' iii, 51. 'Carpenter's Phys.,' 7th edition, p. 686.

intense than is the case in adults.[1] So that, here again, the olfactory incompetence may not unreasonably be attributed to the deficiency of pigment.

It may, however, be objected that, if the view I have now advanced were true, all albino animals—man and mammals alike—should be destitute of smell, or, at any rate, very deficient in this respect. Were *all* pigment absent from the body this very possibly might be the case, and the history of the negro boy which I have given supports this opinion. But I would point out that an entire absence of pigment, if it ever happens, is at any rate an excessively rare occurrence. Even in the whitest-skinned animals there is, as a rule, if not always, some pigment; and it is a notable fact that the last place which the pigment deserts is the skin of the face, and especially the skin about the nose and ears. Now, the internal nasal and aural cavities are formed by an involution of this outer skin; and we may, therefore, not unreasonably assume that the persistence of pigment in these portions of the skin is a probable indication of persistence of pigment in the involuted organs. And this assumption is borne out by the observed fact that such a connection does in reality exist between the pigment of the eye and that of the neighbouring skin. For it has been stated by Geoffroy St. Hilaire[2] that in what are called "pied" negroes—that is, in negroes whose skin has become white in patches—the eyes are ordinarily without pigment if the skin of the ocular region be white; and, on the other hand, that if the skin of this part retain its ordinary tint, so also do the eyes. This persistence, then, of pigment about those parts of the skin from which the nasal cavities are developed supplies a fifth argument in favour of the view I am advocating. Examples of such persistence are endless. I may recall the well-known instances of black-faced sheep and black-faced cattle. Neither of these are, however, what is called albino; for in both abundant pigment is present in the eyes. A more complete illustration is furnished by certain rabbits. In the variety known as Himalayan not

[1] Cf. 'Frey's Histol.,' s. 664.

[2] 'Hist. des Anomalies,' &c., t. i, 309.

only is the skin and fur of the most snowy white, but the eyes are of the brightest pink. Yet even in these albinos there are invariably patches of dark colour on the nose and ears. Knowing, as we do, how important a part is played by pigment in vision, we should have expected that the eye would have been the last part to surrender its colouring matter; whereas, we find that, though very persistent there, the pigment is still more persistent in nose and ears.

We can understand, then, why albino animals should not necessarily be destitute of smell, even though pigment be required for the due exertion of this sense. Still we should expect that, on the whole, this sense would incline to be less acute in white animals than in those of darker hue. Now, that this is really the case is, I think, rendered highly probable by the following considerations. Feral animals are, it is universally admitted, guided in their choice of food by the sense of smell. It is by the keenness of this sense that herbivora are enabled to avoid poisonous plants and to select nutritious ones. We all know how a horse tests the oats set before it with its nose, and not with its eye. It is plain, then, what an important part the sense of smell plays in the lives of these animals, and what fatal results might occur to them were its exquisite delicacy at all diminished. Their power of discriminating between the wholesome and the unwholesome would be lost, and they would fall victims to the first poisonous plant that chance might throw in their way. Now, it is not very uncommon for such an accidental poisoning to occur; and it is in striking harmony with my hypothesis, that in the vast majority of such cases the poisoned animal is a white one; that is, an animal whose sense of smell would be likely, according to my view, to be somewhat obtuse. The facts which I shall cite in support of this statement I take partly from a paper written many years back by Prof. Heusinger,[1] partly from the rich storehouse of Mr. Darwin's works.[2] In some parts of Virginia the farmer will only rear black pigs because the white ones eat and are

[1] See Schmidt's 'Jahrbücher,' 1847, p. 281.

[2] 'Animals and Plants under Domestication,' ii, 335.

poisoned by the roots of the Lachanthes tinctoria. Professor Wyman, who was struck by the absence of white pigs from the district, was told by one of the squatters that "we select the black members of the litter for raising, as they alone have a good chance of living." In the Tarentino, again, the inhabitants only rear black sheep, because the white ones eat and are poisoned by the abundant Hypericum crispum of that region. So accounts are given of white horses eating poisonous food, while the coloured horses escape. White rhinoceroses are said to perish from eating the Euphorbia candelabrum; not so the black.

I am indeed aware that Mr. Darwin and other writers have given a different account of this matter. They suppose that both coloured and white animals alike eat the poisonous food; but that, owing to some hidden constitutional peculiarity correlated with their colour, the white animals are poisoned by a plant which is innocuous to the black or coloured.[1] I cannot, however, find out that there is any positive evidence that the coloured or black animals really *do* eat the plants in question. Nowhere can I find the statement of an eye-witness of such an occurrence. I suspect, therefore, that it has been merely an assumption that they do so, it having not unnaturally been taken for granted without strict inquiry that what one horse or sheep will eat another horse or sheep will eat also. In the absence of clear proof to the contrary I cannot but think it more likely that the white animals suffer because they eat the poisonous plants, while the black animals escape because they avoid them; and I think I have shown fair grounds for suspecting that the explanation of this difference of habits is to be found in differences of acuteness of smell, depending on the presence or absence of abundant pigment in the olfactory region.

[1] That a relation exists between the colour of animals and their susceptibility to poisons is an opinion as old as Aristotle, who says ('Hist. Anim.,' viii, 28) that the bite of a scorpion is much more dangerous to a black sow than to a white one: "*καὶ τὰς ὗς, αἱ ἥκιστα αἰσθάνονται τῶν ἄλλων δηγμάτων, καὶ τούτων τὰς μελαίνας μᾶλλον ἀποκτείνουσι.*"

What an advantage in the struggle for existence a keenly smelling animal must have over one of more obtuse sense is manifest.[1] If it be carnivorous it will detect its prey the sooner, and follow it the more surely. If it be herbivorous it will avoid poisonous food with greater precision, and will, moreover, have earlier notice of the approach of a foe, and so more time for escape. It is not, therefore, surprising that, with animals living in their natural condition, whiteness should scarcely exist except as a monstrosity, all wild breeds being more or less coloured;[2] nor that attempts to stock woods with white rabbits should have failed, the white variety being supplanted in a very short time by coloured ones.[3]

Another argument in favour of my hypothesis is, I think, to be drawn from those albino rabbits to which I have already

[1] Doubtless there are other causes besides obtuseness of smell which render whiteness disadvantageous to wild animals. They are, for instance, as Mr. Darwin and Mr. Wallace have pointed out, much more conspicuous to their foes. Besides, they suffer much more from exposure to strong sunlight than do coloured ones. A white man if so exposed—and especially if parts usually covered, and so whiter, are exposed—is soon blistered. A black man suffers no inconvenience. There is the same difference in the effects on white and on black animals. The white suffer; the black escape. If an animal be partly white, partly coloured, then excessive sunshine often causes inflammation and loss of hair on the white parts, while the black parts are uninjured. There are many such cases on record. These ill effects seem not to be due, as is usually supposed, to the heat, but to the light. For, in the first place, black is no protection against heat, but the contrary. Secondly, prolonged exposure to much greater heat than that of bright sunshine, for instance, to that of a Turkish bath, does not blister one's skin. Thirdly, prolonged exposure to strong light, without intense heat, *does* blister the skin, as all know who have walked much in the glaring snow regions of the Alps. The use of the black skin to men and animals seems to consist in the black absorbing the rays of light, and converting them into heat.

[2] I am not a sufficient adept in natural history to say how many wild breeds of mammals are white. The following are such as occur to me. The white polar bear: but in this animal the muzzle, the tongue, the eyelids, the mouth, are black. The white cattle of Chillingham have black muzzles and black eyes. The white oryx has dark patches about head and nostrils. The white arctic fox has, even in summer, jet black nostrils. The white whales of Spitzbergen appear to have no coloured parts, but they are also supposed to have no sense of smell, or very obtuse smell.

[3] Cf. Darwin, op. cit., ii, 230.

referred. These are born perfectly white, and remain so for several months, in fact, until they are weaned. It is then only that the patches of colour appear about the nose and ears. Now, if the presence of pigment be, as I suppose, intimately connected with acuteness of smell, this development of pigment when the animal is first left to its own resources becomes intelligible. For it is plain that while the suckling lives at the expense of its mother it has no need for keen scent, but that so soon as it has to shift for itself and select its own appropriate food, this sense, as we have already seen, becomes of paramount importance.

The probability of this explanation is very much increased by what we know of such other changes as occur in the young animal at this period. For these all have the most unmistakeably direct reference to the new diet on which the weaned animal is henceforth to feed. Such a change is the development of teeth, now first required for mastication. Such, also, is the alteration which now occurs in the salivary secretion. So long as the animal is sucking, its saliva is incapable of converting starch,[1] none of which is present in milk; but the secretion acquires this faculty about the time when the animal is weaned, and begins to live on a diet in which starch is an important ingredient (Schiff). Such, also, is the change which about this period occurs in the gastric juice. This in the suckling acts energetically by means of its pepsine upon milk, which it coagulates; but the pepsine of the weaned animal is entirely destitute of this power (Wasmann). Thus the absence of pigment from the Himalayan rabbits in the first months of their existence, and its development at the period of weaning, is, by my hypothesis, brought into the most complete harmony with the

[1] There is one exception to this general statement. The saliva of the newborn guinea-pig converts starch (Schiff, 'Digestion,' i, 206). But the apparent exception is really a confirmation. For this animal is born in a much more advanced condition than other mammals. It can run about and pick up food for itself almost as soon as it is born. It is from the first independent of its mother's warmth (Carpenter, 7th ed., p. 495); and it succumbs to asphyxia as rapidly as do adults, being destitute of the power of resistance which belongs to other young mammalia (B. Séquard's 'Journ. de Phys.,' ii, 93). Indeed, it is not born until it has already shed certain deciduous teeth (Cuvier).

other structural changes which occur at this period of the animal's life.

It may perhaps appear to some that this question is one which could be easily solved by simple experiments; that we have only to take white and coloured animals of the same species, and directly test their relative acuteness of olfaction. But a very little consideration will show that such a method would in this matter be perfectly impracticable. Were it indeed a question of entire absence of smell, then we might hope for a solution, though physiologists have found it difficult enough to decide even as to total anosmia in animals. But when the question is not of total loss of smell but merely of degrees of acuteness, what was a difficulty becomes an impossibility. Let any one try to classify some dozen men by their differences in this respect. He will find it almost impossible. Yet we may suppose that by applying aromatic substances to the nostrils or palate of each in succession, and carefully noting the account each gave of his sensations, we might, in time, arrive at some rough conclusion. But, clearly, if the men were all deaf and dumb and unable to give any account whatsoever of their sensations, even this imperfect result would be unattainable. We possess then no gauge by which to test directly the acuteness of smell in dumb animals; and we must content ourselves with the less direct plan of observing how far they perform unerringly such actions as imply keen scent. One such action is the avoidance of poisonous plants, and I have already shown that there are reasons for suspecting that coloured animals do this with greater precision than do white ones.

We come now to the final question. Is there any conceivable mode in which we can imagine the olfactory pigment to affect the reception of olfactory impressions? In the eye we can partly understand how the pigment may act, but in the nose no obvious explanation is at hand. There are, however, some observed facts respecting odours, which, I think, may perhaps give us a clue. It has been noticed by several writers that dark substances absorb odours much more readily than do light ones. "Haller, of Vienna,"—I quote from Dr.

Murchison's book on Fevers, "observes that dark coloured materials of clothing are more prone to absorb the contagion of typhus and to convey it to other individuals than those which are light coloured. He found that among troops wearing dark coloured uniforms it more frequently happened that new cases of typhus entered the hospital after a convalescent patient had rejoined his corps, than among those wearing light or white uniforms. It may be mentioned that in dissecting-rooms dark clothes acquired the cadaveric odour sooner and were deprived of it less readily than light ones; and he ascertained by experiments that the absorption of odours is regulated by the laws which govern the absorption of light."[1] Experiments have also been made by Dr. Stark, of Edinburgh, in order to determine the differences in this respect of differently coloured substances. He found that black was the most powerful absorbent of odours; next in order came blue; then, successively, with decreasing intensity, green, red, yellow, and, last of all, white; in this absorption was reduced to the minimum.[2] Like experiments were afterwards made by A. Dumeril,[3] of Paris, and with practically like results.

Here, then, we have a possible explanation of the matter. The pigment which is so constant in the olfactory region is there to absorb the odorous emanations. The darker the tint of the pigment, and the wider its extension, the greater will the absorption be. Hence the keen scent of black or coloured animals and men. The lighter the pigment, or the smaller the surface over which it extends, the less on the other hand will be the absorption of odours. Hence the comparatively frequent poisonings of white animals. When the pigment is altogether absent, then absorption will be at its minimum. Hence the anosmia of the white negro whose case has led me to this discussion.

I have now nearly finished what I have to say of smell. I cannot, however, refrain from pointing out briefly that there

[1] Op. cit., p. 88.

[2] Longet's 'Physiol.,' iii, p. 36, 3rd ed.

[3] 'Des Odeurs, de leur Nature et de leur Action Physiologique.' Paris, 1848.

seem to me to exist some grounds for believing that pigment plays a part even in the reception of auditory impressions.

In the membranous labyrinth black pigment is found in varying amounts. As to the exact position of this pigment in man, and its relation to the ultimate nervous organs, nothing accurate has been ascertained. But in the labyrinth of certain fishes the arrangement has been made out, and it is of importance to note that the relation here of the pigment to the ultimate nerve organs is identically the same as exists in the olfactory region of higher animals; so that a diagram of the one organ will almost stand for a diagram of the other.[1] In each the ultimate nerve-organs consist of certain cellular prolongations, and in each interposed between these ultimate nerve-organs are pigmented epithelium cells.[2] This similarity of arrangement renders it highly probable that there is also some similarity of function. So that, if it be admitted that the pigment in the nose serves any purpose, it will be highly probable that the pigment in the labyrinth serves a like use. Secondly, we find among mammalia generally the same tendency to retention of pigment in the skin of the ears which I have already pointed out as existing about the nostrils; and the membranous labyrinth is developed by an involution of this external integument.[3] Thirdly, in some animals there does most certainly exist a strange connection between the amount of pigment in the body, and the sense of hearing. Sichel[4] pointed out, many years ago, and Mr. Darwin has since made the fact generally known, that cats with pure white skin

[1] The same diagram will also serve fairly to represent the termination of the nerves of taste in the frog's tongue. Here, also, according to the researches of Axel Key, made under the direction of Max Schultze, the nerve-fibres are connected with certain terminal cells, resembling those of the olfactory region, and interposed between these terminal cells are epithelium cells containing yellow pigment granules. (Cf. Funke's 'Phys.,' ii, 82.)

[2] Cf. Fick, 'Sinnesorgane,' fig. 30.

[3] According to Huschke's discoveries, confirmed by Reissner and Remak. Cf. Kölliker's 'Manual of Micr. Anat.,' p. 600.

[4] 'Ann. des Sciences Nat.,' 3me Série, Zoologie, viii, 239.

and blue eyes are almost invariably deaf. Should the perfect white be marred by a single blotch of colour, then the deafness is absent. Or even should a kitten born without pigment, and therefore deaf, develop pigment at a later period, the deafness will cease. A white kitten was found by Sichel to be quite deaf. When it was four months old the iris began to assume a darker tint, and with the development of pigment came also the sense of hearing.[1] Lastly, abnormal pigmental constitution, as shown by the tendency to pigmental retinitis, is known to be frequently associated with partial or complete deafness. Dr. Laycock observed[2] five cases of such association in a single family, and out of 241 deaf mutes at Berlin Liebreich found no less than fourteen to be afflicted with this comparatively rare pigmental disease.

All these various facts cohere into a consistent whole if we imagine that the pigment of the membranous labyrinth is a part of the mechanism of hearing, but, without such a supposition, admit, so far as can be seen, of no intelligible explanation. For to say that they are instances of correlation of growth is of course no explanation. It is merely to state in different terms the fact of the frequent combination in an individual of two peculiarities.

It would appear, then, not improbable that the organs of three main senses, sight, smell, hearing, require each, for the full performance of its function, the presence of pigment. One cannot, therefore, but be inclined to inquire whether they may not want it for some common purpose. In each of the organs the pigment is not contained within the nerve-structures themselves, but lies external to these and in immediate contiguity with their ultimate elements. Thus, in the eye it is in contact with the cones and rods of the retina; in the nose in contact with the olfactory cell-processes; in the aural ampullæ with similar cell-processes which form the terminal bodies of the auditory nerve. As in each case

[1] This observation appears to me to lend additional probability to the supposition advanced at pages 283–4 as to the appearance of pigment in Himalayan rabbits at the period of weaning.

[2] 'Med. Times and Gaz.,' 1866 and 1867.

the pigment is thus external to the nerve structures, its use is more probably connected with the reception than with the transmission of sensory impressions. Seeing that both in the eye and in the ear the sensory impression is known to result, not from the contact of material particles given off by the object seen or heard, but from waves or undulations of ether or of air, one cannot but suspect that the same may be true in the remaining sense, and that the undulatory theory of smell, deriving also, as it does, support from some other facts, may, perhaps, after all be the true one. This supposition would clearly be greatly strengthened could it be shown that pigment is in any way specially suited for the absorption or modification of undulations.

Now, it has been known since the days of Franklin that the absorption of waves of heat is greatly affected by the colour of the absorbing substance; and that differently coloured substances absorb the waves of light in different proportions, and, in fact, owe their different colour to this is, of course, a recognised fact, the wave of light thus absorbed being converted into undulations of heat. We have seen also that these coloured substances apparently behave towards odours much in the same way as they behave towards light. The corroboration, then, is not wanting.

Now, in the case of the eye, Professor Draper has argued, as it appears to me with good reason, that the image is not formed, as is usually said, upon the transparent retina, but on the screen of black pigment which lies behind. By this he believes the rays of light to be absorbed and converted into vibrations of heat, so that what was at first a light-picture is now, so to speak, a heat-picture, in which each different shade and colour is represented by a different degree of temperature. "In this local disturbance of temperature," in his opinion, "the act of vision commences, the club-shaped particles of Jacob's membrane being truly tactile organs which communicate to the sensory surface of the retina the condition of temperature of the black pigment."[1]

Doubtless, this view of Professor Draper's is not the

[1] Draper's 'Physiol.,' p. 392.

current one. Admitting it, however, to be true, one cannot but ask whether a similar function may not attach to the similarly placed pigment of the nose and ear—whether this also may not serve to absorb vibrations of odour and of sound, and to convert them into vibrations of heat, which will affect the contiguous cells, in which, as we have seen, the olfactory and auditory nerves find their termination.

This claims, of course, to be no more than a speculation, and even as such is open to one manifest objection. Physicists do not recognise the existence of any relation between the pigmentation of substances and their power of absorbing sound. To this, however, I would reply that physicists, to the best of my belief, have not yet experimented on the matter, and that it is not impossible that such a relation may exist, undiscovered, because unlooked for; just as a similar relation between pigmentation and the absorption of odours has lain for ages unsuspected and therefore unknown.

Be this, however, as it may, my object will have been attained if I shall have succeeded in calling the attention of physiologists to the constant presence of pigment in the terminal organs of hearing and of smell, and to the many reasons there are for believing that it plays there some part; perhaps, one not less important than has been long conceded to it in the organ of sight.

REPORT OF THE COMMITTEE

APPOINTED BY THE

ROYAL MEDICAL AND CHIRURGICAL SOCIETY

TO INVESTIGATE

BAIN'S AND PACINI'S METHODS

OF

RESTORING SUSPENDED ANIMATION.

Members of the Committee.

W. S. Savory, F.R.S. (*Chairman*); J. B. Sanderson, M.D., F.R.S.; Henry Power; Thomas P. Pick (*Secretary*); G. Gascoyen (*ex officio*).

At the first meeting of the Committee it was resolved to pursue the inquiry by means of experiments upon the dead human body.

It was determined that these experiments should be made at St. George's Hospital; and the Committee have to return their thanks to the medical officers of this institution for their kindness in placing four subjects at its disposal, by which means they have been enabled to make eighty-three different observations, the results of which are appended.

Method of investigation.—In order to ascertain the relative merits of the two methods referred to the Committee, not only to each other, but also to other methods already in use, they were contrasted with the plan proposed by Dr. Silvester, the three modes being employed alternately on the same subject. In some of the experiments the operator was the same in all three classes of cases; in others, the Committee had the advantage of seeing Dr. Silvester and Dr. Bain perform their own experiments in the manner advocated by themselves.

The means which were employed to ascertain the actual quantity of air alternately introduced into the respiratory cavity and expelled therefrom by the several mechanical expedients was the instrument designed by Dr. Sanderson, and employed by a former committee of the Royal Medical and Chirurgical Society appointed to report on the subject of suspended animation.[1] In all the experiments the apparatus was directly connected with the trachea.

The mode in which artificial respiration is performed in the two methods under investigation is thus described by their respective advocates.

Professor Pacini describes his plan in a pamphlet, entitled 'Di un nuovo Metodo di Practicare la Respirazione Artificiale,' as follows:—"Supposing that the asphyxiated patient is on a horizontal plane above the ground, as a bed or a table, the operator stands with the head against his own abdomen, and then with his hands takes a firm hold of the upper part of the arms, applying the four fingers behind and close to the armpit, while the thumb is in front of the head of the humerus. Having thus seized both shoulders, he then pulls them towards him, and then lifts them in a perpendicular direction, by which means the sternum is first raised by means of the clavicle and, in consequence, the ribs, which, diminishing their obliquity with the spine, enlarge the thoracic cavity both in its transverse and antero-posterior diameters. If the patient is lying on the ground, it is easy

[1] The instrument is described and figured in the 'Medico-Chirurgical Transactions,' vol. xlv, p. 469.

to understand that the operator may then place himself on his knees so that the head may remain firmly placed against them. It is, however, necessary to explain that, in order to effect more fully the elevation of the chest, the rest of the body should not be allowed to yield to the traction, but should be fixed; so that, when the weight of the body does not offer sufficient resistance, an assistant should use counter-extension by holding the feet or by fastening them to some immovable object."

Dr. Bain thus describes his method:

"The patient being laid on his back on a table, if convenient, the mouth and nostrils are to be wiped dry, the clothes from the upper part of the body, at least, having been removed. The operator stands at the head of the patient, placing the fingers of each hand in the axilla in their front aspect, with the thumbs on the clavicles, and pulls the shoulders horizontally towards him with a certain degree of power. Upon relaxing his pull the shoulders and chest return to their original state."

Dr. Bain also occasionally employs another plan, which he terms his "second method," and which he thus describes:

"The shoulders are elevated by taking hold of the hands and raising the body about a foot off the table, the arms being elevated at an angle of 45° over the head."

The following are the results of the observations:

June 23rd, 1869.—*At St. George's Hospital.*

Present.—Dr. Sanderson, Dr. Bain, Mr. Savory, Mr. Power, Mr. Gascoyen, and Mr. Pick.

SUBJECT I.—A well-formed woman, aged 56, who had died of obstruction of the bowels, and who had no disease of the lungs. Had been dead twenty-one and a half hours.

Observation 1.—Dr. Silvester's method. Body lying flat on the back, with the head resting on the table. Elevation of both arms was attended by the introduction of 18 cubic inches into the lungs. On

replacing the arms to the side 18 cubic inches of air were expelled from the lungs.

Obs. 2.—Repetition of the above. On elevation of arms 20 cubic inches were inspired. On restoration of arms to side 22 cubic inches were expired.

Obs. 3.—Repetition of the above. On elevation of the arms 20 cubic inches inspired. On restoration of arms to side 20 cubic inches expired.

Obs. 4.—Dr. Bain's method. The body lying flat upon the back. The shoulders were firmly grasped and drawn upwards in the direction of the ears. This was attended by the introduction of 26 cubic inches of air. Upon allowing the body to return to its natural condition 26 cubic inches were expired.

Obs. 5.—Repetition of Experiment 4. On elevation of the shoulders 24 cubic inches were inspired. On return of the body to its natural condition 24 cubic inches were expired.

Obs. 6.—Repetition of Obs. 4 and 5. During the inspiratory process 26 cubic inches were introduced into the lungs. During the expiratory, 26 cubic inches were expelled.

Obs. 7.—Dr. Silvester's method. Repetition of Obs. 1, 2, 3. The elevation of the arms was attended with the introduction of 21 cubic inches into the lungs. Upon replacing the arms to the side 21 cubic inches were expelled.

Obs. 8.—Upon repeating this experiment 22 cubic inches were introduced, and 22 cubic inches expelled.

Obs. 9.—A third repetition of the experiment was attended by the introduction of 23 cubic inches, and the same amount was expelled.

Obs. 10.—Dr. Bain's method. Repetition of Experiments 4, 5, 6. During the inspiratory process 29 cubic inches were taken into the lungs, and 28 expelled from them during expiration.

Obs. 11.—Upon repeating this experiment 25 cubic inches were introduced and 24 expelled.

Obs. 12.—A repetition of Obs. 10 and 11 was attended with the introduction of 26 cubic inches and the expiration of 25 cubic inches.

Obs. 13.—Dr. Silvester's plan. The shoulders of the subject were now raised by placing a block under the chest and the head thrown back. Elevation of both arms in the same manner as in the first experiment was attended by the introduction of 27 cubic inches of air into the lungs. On replacing the arms to the side 24 cubic inches were expired.

Obs. 14.—Repetition of Obs. 13 was followed by the introduction of 24 cubic inches and by the expiration of 23.

Obs. 15.—This experiment repeated produced 23 cubic inches during inspiration and 24 cubic inches during expiration.

Obs. 16.—Dr. Bain's method. The subject being placed in the same position as in the last three experiments, with the shoulders raised. During the inspiratory process 25 cubic inches were introduced; during the expiratory 24 cubic inches were expelled.

Obs. 17.—Repetition of the last observation. The inspiratory process was attended with the introduction of 24 cubic inches, and the same amount was expelled during the expiratory process.

Obs. 18.—On the third experiment the amount introduced was 25 cubic inches; the amount expired was 24 cubic inches.

Obs. 19.—The last three experiments were repeated, Mr. Power (instead of Dr. Bain) performing them. Inspiration was attended with the introduction of 27 cubic inches. During expiration 26 cubic inches were expelled.

Obs. 20.—Upon repeating Obs. 19, 26 cubic inches were inspired, 25 were expelled.

Obs. 21.—A repetition of this produced 27 cubic inches inspired, 26 expelled.

Obs. 22.—Pacini's method. The method recommended by S. Pacini was now tried. In the first experiment (performed by Dr. Bain), during the inspiratory act 16 cubic inches were introduced into the lungs; during the expiratory act 16 cubic inches expired.

Obs. 23.—Upon a repetition of this experiment 20 inches were inspired and 20 expired.

Obs. 24.—This repeated produced a result of 21 cubic inches introduced during inspiration and a like amount expelled during expiration.

Obs. 25.—These last three experiments were repeated, another gentleman (Mr. Power) performing them. During the inspiratory act 34 cubic inches were introduced; during the expiratory 30 cubic inches were expelled.

Obs. 26.—This repeated produced during inspiration 32 cubic inches introduced; during expiration 32 cubic inches expelled.

Obs. 27.—On a third experiment, the introduction of air was 32 cubic inches; the amount expelled was the same.

Obs. 28.—Dr. Bain's second method. One experiment was performed. This produced during inspiration the introduction of 31 cubic inches of air; during expiration 30 cubic inches were expelled.

July 17th, 1869.—*At St. George's Hospital.*

Present—Dr. Sanderson, Dr. Bain, Mr. Savory, Mr. Power, Mr. Gascoyen, Mr. Pick.

Subject II.—A male, aged 60, who had died of cirrhosis of the liver and ascites, and in whom there was slight emphysema of the lungs. The weather was very warm, and the muscles relaxed and flaccid. He had been dead 33¼ hours. Prior to experiment the fluid in the abdomen was drawn off.

Obs. 1.—Dr. Bain's method. The subject lying flat on the table. During inspiration 17 cubic inches of air were introduced into the lungs, and during expiration 18 inches were expelled.

Obs. 2.—Experiment repeated. Eighteen cubic inches were introduced and a like amount expelled.

Obs. 3.—On repetition 17 cubic inches were inspired, and after the lapse of a minute 21 cubic inches were expelled.

Obs. 4.—Dr. Silvester's method. The head and shoulders being raised by means of blocks. In the first experiment 19 cubic inches were introduced, and on replacing the arms to the side, after the lapse of a minute, 14½ cubic inches were expelled.

Obs. 5.—The last experiment repeated, attended by the introduction of 15½ cubic inches and the expulsion of 16 cubic inches.

Obs. 6.—Repetition of the two preceding experiments showed an introduction of 15 cubic inches, and the expulsion of 17 cubic inches.

Obs. 7.—Method recommended by S. Pacini. The subject lying flat on the table. Upon raising the shoulders, in the manner recommended by this gentleman, the index showed an introduction of 7 cubic inches, and after the lapse of 1 minute it showed that a like amount of air had been expelled.

Obs. 8.—A repetition of this experiment gave the same result.

Obs. 9.—Upon repeating it a third time only 6 cubic inches were taken into the lungs, but 7 were expelled.

Obs. 10.—These three sets of experiments were repeated. Dr. Bain's method. The first inspiratory process was attended with the introduction of 22 inches and the expulsion of 21.

Obs. 11.—A repetition of the experiment was attended with a like amount inspired and 23 expired.

Obs. 12.—Experiment repeated. The index gave 23 inspired and a like amount expired.

Obs. 13.—Dr. Silvester's method. The shoulder being raised. First experiment gave 19 cubic inches inspired, 3½ expired.

Obs. 14.—Experiment repeated gave 14½ cubic inches introduced into the lungs, 14 expelled from the lungs.

Obs. 15.—Experiment repeated gave 16 cubic inches taken in and 17 expelled from the lungs.

Obs. 16.—S. Pacini's method. First experiment gave a result of 8 cubic inches inspired and 8 expired.

Obs. 17. Repetition of experiment. Same result as far as inspiration was concerned, but 10 cubic inches were expelled.

Obs. 18.—Experiment repeated. Ten cubic inches were introduced, 9½ expelled from the lungs. These experiments were then repeated with the addition of a 14 lb. weight being placed on the chest during expiration with the following results,

Obs. 19.—Dr. Bain's method. In the first experiment 25 cubic inches were introduced and a like amount expelled.

Obs. 20.—Experiment repeated. Thirty-one cubic inches of air were taken in, 28 cubic inches were expelled.

Obs. 21.—Experiment repeated. Twenty-eight cubic inches were introduced, 30 expelled.

Obs. 22.—Dr. Silvester's method. On raising the arms 26 cubic inches were taken into the lungs; on replacing them, with the weight on the chest, 20 were expelled.

Obs. 23.—Experiment repeated. Twenty-two cubic inches inspired, 22 expired.

Obs. 34.—Experiment repeated. The same amount inspired, 20 cubic inches expelled.

Obs. 25.—S. Pacini's plan. The first experiment gave only 4 cubic inches introduced and 8 expelled.

Obs. 26.—Repetition of experiment. Eight cubic inches were inspired and 10 expired from the lungs.

Obs. 27.—Repetition of experiment. Nine cubic inches were introduced and 10 expelled.

Obs. 28.—Dr. Silvester's method. Seizing some part of the upper arm and employing a 14 lb. compression during expiration. At the first attempt 17 cubic inches were introduced and 12 expelled from the lungs.

Obs. 29.—Repetition of the last experiment. Twenty cubic inches were inspired and a like amount expired.

Obs. 30.—Dr. Bain's second method. Thirty-one cubic inches were introduced, and 26 expelled from the lungs.

All the experiments on this subject were performed by the same gentleman (Mr. Pick). At the termination of each experiment one

minute was allowed to elapse before the final reading of the index was taken.

At the conclusion of the experiments the apparatus was tested in regard to its accuracy.

April 2nd, 1870.—*At St. George's Hospital.*

Present—Dr. Sanderson, Dr. Bain, Dr. Silvester, Mr. Savory, Mr. Power, Mr. Pick.

Subject III.—A well-formed and well-nourished woman, aged 22, who had died of acute cerebral disease, who had no disease of the lungs. Had been dead 29 hours. Rigor mortis well marked.

Obs. 1.—Dr. Bain's method, experiments performed by Dr. Bain. The body lying flat. In the first experiment 15 cubic inches were introduced into the lungs and 12 expelled from the lungs.

Obs. 2.—Repetition of the above. Seventeen cubic inches were introduced and 16 expelled.

Obs. 3.—Repetition of the above. Fifteen cubic inches were taken into the lungs and 14 expelled.

Obs. 4.—Dr. Silvester's method. The shoulder raised. Experiments performed by Dr. Silvester. At the first attempt 11½ cubic inches were taken into the lungs and 11 were expelled.

Obs. 5.—The repetition of the experiment produced 19 cubic inches inspired and 15 cubic inches expelled.

Obs. 6.—Experiment repeated. Fourteen and a half cubic inches inspired and a like amount expired.

These experiments were repeated, but before the method was adopted expiration was performed by compression of the walls of the chest.

Obs. 7.—Dr. Bain's method. The body lying flat on the table. Experiments performed by Mr. Pick. Expiration was effected by pressing on the lower third of the sternum with the hands. In the first experiment 9½ cubic inches were first expelled from the chest; upon employing Dr. Bain's method 30 cubic inches were introduced into the lungs, and upon replacing the arms to the side and concluding the experiment 16 cubic inches were expelled.

Obs. 8.—Repetition of the last experiment. Twelve cubic inches were first expelled, then 28½ were introduced, and finally 16½ expelled from the lungs.

Obs. 9.—Repetition of last two experiments. Thirteen cubic inches were first expelled, then 30 cubic inches were introduced and 17 expelled.

Obs. 10.—Dr. Silvester's method. The shoulders being raised. Experiments performed by Mr. Pick. Expiration was effected by pressing the patient's arms firmly against the chest. In the first experiment in the preliminary expiration 12½ cubic inches were first expelled, 24½ were then introduced by employing Dr. Silvester's method, and upon replacing the arms to the side 11½ were expelled.

Obs. 11.—Repetition of the last experiment. In the preliminary expiration 11½ cubic inches were expelled, then 24 were introduced, and finally 12 were expelled.

Obs. 12.—Repetition of two preceding experiments. Eleven cubic inches were first expelled, then 23 were introduced, and finally 11 were expelled.

Obs. 13.—Dr. Bain's second method. By this plan 16 cubic inches were introduced and 14 expelled.

April 8th, 1870.—*At St. George's Hospital.*

Present.—Dr. Sanderson, Dr. Bain, Dr. Silvester, Mr. Savory, Mr. Power, Mr. Pick.

SUBJECT IV.—A thin and emaciated woman, aged 46, who had been dead twenty-three hours. Rigor mortis very slightly marked.

The experiments on the preceding subject were repeated.

Obs. 1.—Dr. Silvester's method. Experiments performed by Mr. Power. The middle of the arm being grasped, expiration performed in the same way as in the preceding experiments, by pressing the arms against the chest. During the preliminary expiration 14 cubic inches were expelled; 31 cubic inches were then introduced by Dr. Silvester's method, and finally, upon replacing the arms to the side, 12 cubic inches were expelled.

Obs. 2.—Repetition of last experiment. In the preliminary expiration 20 cubic inches were expired, 40 cubic inches were taken into the lungs, and 12 cubic inches expelled.

Obs. 3.—Repetition of last two experiments. In the preliminary expiration 25 cubic inches were expelled, 38 cubic inches were introduced, and 13 cubic inches were expelled.

Obs. 4.—Dr. Bain's plan. Experiments performed by Mr. Power. Expiration, as before, by compressing the sternum. During the preliminary expiration 28¼ cubic inches were expelled; 43 cubic inches were then introduced and finally 11 inches expelled.

Obs. 5.—Repetition of last experiment. Nineteen cubic inches were expelled during the preliminary expiration; 40 cubic inches were then introduced and 12 cubic inches expelled.

Obs. 6.—The last two experiments repeated gave a preliminary expiration of 27 cubic inches, an introduction of 42 cubic inches, and a final expiration of 14 cubic inches.

Obs. 7.—Dr. Bain's method, performed by himself. At the first expiration 21 cubic inches were expelled, then 42 cubic inches were introduced, and finally 18 were expelled.

Obs. 8.—Repetition of last experiment. Twenty-two cubic inches were first expelled, 40½ were introduced and 18 expelled.

Obs. 9.—Repetition of last two experiments. Twenty-three cubic inches were first expelled, 40 were introduced and 17 expelled.

Obs. 10.—Dr. Silvester's method, performed by himself, but grasping the arms just below the shoulders. In the first attempt 14 cubic inches were first expelled, then 36 cubic inches were introduced, and finally 14 were expelled.

Obs. 11.—Repetition of last experiment. In the first expiration 18 cubic inches were expelled, 35 were introduced, and finally 14 cubic inches expelled.

Obs. 12.—Repetition of last two experiments. Seventeen cubic inches first expelled, 30 then introduced, and finally 15 expelled.

Analysis of the preceding Experiments.

	Number of experiments.	Average number of cubic inches inspired.	Average number of cubic inches expired.
SUBJECT I.—			
Silvester	9	22·0	21·9
Bain	13	26·1	25·5
Pacini	6	25·8	25·1
SUBJECT II.—			
Silvester	11	18·7	16·9
Bain	10	23·5	23·3
Pacini	9	7·4	8·5
SUBJECT III.—			
Silvester	6	19·4	12·5
Bain	7	21·6	15·0
SUBJECT IV.—			
Silvester	6	35·0	13·3
Bain	6	41·1	15·0

From these experiments it appears that more air is introduced as a rule by traction from the shoulders than from the forearms and arms. Nevertheless it will be seen that in the amount of air introduced there is a greater difference when the same method is adopted with different bodies than there is between the two plans when practised upon the same body —this great difference being chiefly due to the size of the body, especially the amount of the mobility of the walls of the chest, and the rigidity of the muscles.

By either plan the Committee are of opinion that a sufficiently large quantity of air is without difficulty introduced. And it may be observed that in either case on an average more air is changed than in the act of ordinary tranquil respiration.

In estimating the relative merits of the two plans they are anxious to observe that other considerations are involved than that of the absolute and comparative quantity of air changed.

They are unanimously of the opinion that the method advocated and practised by Dr. Bain is but a modification of the plan usually known as Silvester's, and involves no new principle of action. Indeed, in his more recent publications, Dr. Silvester has not limited his point of traction to any one part in particular of the forearm or arm. They are, therefore, of opinion that in the great majority of cases it is of comparatively little moment which method of manipulation is practised, provided the common principle on which both are founded be fairly carried out.

W. S. Savory (*Chairman*).
J. B. Sanderson.
H. Power.
G. G. Gascoyen.
T. P. Pick (*Reporter*).

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PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

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